The Balance Between Technology and Culture in Sustainable Architecture

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**A thesis submitted to
The Faculty of Graduate Studies and Research
In Partial Fulfillment of
The requirements for the degree of**

Master of Architecture

**School of Architecture
Carleton University
Ottawa, Ontario
September 2004
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ISBN: 0-612-99014-1

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ISBN: 0-612-99014-1

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ABSTRACT

After several decades, sustainable architecture has stepped into a crucial phase. The current sustainable design mainly focuses on technological innovation and installation, whereas neglects cultural expression and contextual connection. By defining the meaning of environment and sustainable architecture, a series discussion is undertaken, including the relationship of culture and nature, their influence on architecture, and architecture's respective reaction. Consequently, the paper comes into a conclusion that sustainable architecture in a real meaning should not exclusively respond to natural environment, but also need to be harmonious with cultural surroundings. By looking at two pragmatic works of Norman Foster, the thesis analyses the design concepts of both cases based on different backgrounds, which leads to a comparison of the manipulations of culture and technology in these two projects. Finally the case studies demonstrate the vitality of cultural elements and the necessity of balancing cultural and technological components in the future development of S.A.

ACKNOWLEDGEMENT

My greatest debt is to my supervisor, Professor Steve Fai whose criticism and support has been so priceless to me. It was he who supported me when I was facing difficulties and obstacles. All the experience I have gained from this thesis will benefit me for the whole life ever.

My endless love and appreciation to my parents --- You are the best! I am so lucky to have you two! Except for saying thanks, I don't know how to express my affection --- Thank you for the spiritual and financial support.

I am also grateful to all my friends, especially my classmates in Carleton University Jolly W.J. Shan, Zhen Cao, and Lei Zhang, my friends who also came from my hometown Ellen Y. Feng and Nancy N.Y. Zhang. My sincere thanks for all your supports and encouragements.

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THE BALANCE BETWEEN TECHNOLOGY AND CULTURE
IN SUSTAINABLE ARCHITECTURE

CHAPTER 1 INTRODUCTION

Prelude:

Plenty of literature has expressed the idea that as we enter a new millennium, human beings are at a crossroad in the development of civilization. The depth of human involvement in culture is affected by triumphant scientific approaches and economic imperialism. Many concepts have been obscured because of this transformation of the human understanding of the world. The analysis of sustainable architecture is initiated from my reappraisal of a basic question --- how to define architecture, that is to say, what can be considered “architecture”? This question and its answer set up the basic premise for my further exploration in a particular type of “architecture” --- sustainable architecture.

Architecture can be described as “the **art** and **science** of designing a building having qualities of beauty, geometry, emotional and spiritual power, intellectual content and complexity, soundness of construction” (Curl 32). Architecture is concerned with a double characteristic – aesthetics (cultural) and tectonics (technological). John Ruskin, in his Seven Lamps, especially emphasises the cultural feature of architecture by saying that architecture is the “art which so disposes and adorns the edifices raised by man ... that the sight of them” contributes “to his mental health, power, and pleasure” (Curl 32). In his opinion, the aesthetic value of architecture as a distinctive property is of more importance than basic structure components.

The problem is that for some reason, such cognition about being “architecture” can be not recognised when it is applied to certain types of architecture. For example, in the same book where James Stevens Curl defines the term “architecture”, he also gives “ecological architecture” and “green architecture” definitions:

- . Ecological Architecture: “Aims to respond to declining energy resources, e.g. using energy conservation, efficient insulation, rainwater, solar radiation, and wind-power, and recycling as much as possible”(Curl 220).

- . Green Architecture: “Buildings designed according to energy-saving criteria and the reduction of pollution”(Curl 288).

Neither of them mentions cultural concerns yet, which makes energy and related technology agenda appear to be the only core consideration. However, Curl’s observations indicate a general understanding of today’s sustainable design concept.

Architecture shows its cultural concerns by responding to cultural system: “context, convention” and contributing to “the constitution of cultural identity” (Hagan 116). Culture is linked to and based on human beings’ memory, and is the collection of shared experiences and the existing context for future achievement. To Aldo Rossi, architecture captures the essence of such memory and endows it with concrete form. He regards that architecture forms the “personality” of built environment, which is “formed of old tradition and living

feeling as well as unresolved aspirations” (Rossi). Individual architecture has to resonate in its community with the same tune.

Problem Statement and Objective Setting:

Sustainable architecture (hereafter abbreviated S.A.) is a concept in architectural design that is based on the sustainable development of human society. Sustainable development refers to a set of long-term development strategies of human society that synthesize environmental, social and economic concerns, which helps to sustain or prolong human beings' existence on this planet. Therefore, as a significant design stream in one of human society's major industries, S.A. design and construction cannot be a simple formula; rather, it has to keep a holistic view during the whole operation. The essence of S.A. is a friendly attitude and a benign relationship with nature. Founded in such a spirit, S.A. cannot be merely a product of modern scientific research or technology, but also --- which hasn't been extensively acknowledged --- an expression of humanity attitude toward nature, a continuity of human cultural heritage and a reference for future development. An initial expectation of S.A. is to call a public attention to our environment problem whilst to demonstrate solutions from architectural perspective. If S.A. is constructed with an enriched culture root, the community who shares the same cultural background will positively recognise the concepts expressed from the buildings. By this means S.A. manifests its considerable persuasive power in educating public the ideology of sustainability.

Hence, based on discussion of the importance of cultural expression in S.A., the **key problem** to be addressed by this thesis is that a balanced consideration between technology installation and culture interpretation is the crucial issue in S.A. practice at present. The **objective** is to develop practical guidelines in S.A. design that pay great attention and respect to local culture in certain context by comparing two pragmatic designs of Norman Foster.

Thesis Organization:

The following chapter format describes sequentially the discussion:

Chapter 2 reviews the environmental movement since last century, specifically in the architectural design field. The purpose is to establish a historical context for this paper, as well as providing a panoramic view of today's S.A. practices, thus preparing for further analysis on the general weaknesses in this design trend.

Chapter 3 establishes the premises of the discussion in this thesis by giving out several definitions. It starts with a definition of S.A., which entails a clarified definition of "environment", for S.A. is often defined as "environmental friendly architecture." The environment human beings dwell in actually contains two essential components: the natural environment and the cultural environment. After an analysis of the relationship between these two components, this thesis

concludes that these two are relatively independent to some extent, yet are fundamentally mutually dependent.

With respect to these two components under the concept of “environment”, architecture should play a mediating role: that is, architecture is a conversation between human being and nature. Inspired by nature, architecture could have two responses: first, it could simply mimic the forms found in nature; or second, it could reflect this inspiration in a more profound way. Because the latter involves much deeper and more abstract inquisitions and interpretations of the nature order, it stands for the moral or intelligent level of a certain era. Noticeably, for that certain era, those inquisitions and interpretations themselves simultaneously compose the major body of culture. This thesis will review several epochs from the Antiquity to the Modern Age, presenting how human understanding of nature has influenced the architectural philosophy and style in different times. Consequently, in this new epoch, as sustainable development reforms the view of nature, S.A. shall physically reflect such a cultural transition and help entire societies step toward the goal of sustainability.

In the next part, the thesis claims that sustainable architecture should be responding to both components, rather than leaving out either of them. Moreover, the importance of deliberated cultural expression in architecture will be addressed again as a crucial consideration in S.A. design.

Chapter 4 looks at two projects of British architect Sir Norman Foster: the new German Parliament Building in Berlin, and the new City Hall of the Greater London Authority in London. From these two designs done by this world-renowned “green architect”, this thesis is going to compare the similarities and differences in these two cases. From City Background, Project Background, and Design Principles three criteria, the paper will analyze and discuss both designs. The purpose of the case study is to present a pair of examples that are examined with respect to S.A. standards; on the other hand, through the comparison, the vitality of cultural elements in pragmatic projects is manifested.

Chapter 5 reviews the logical process of the thesis, draws conclusions, and looks ahead to the further potential development of S.A. It will be argued that contemporary sustainable architecture design has ignored environmental differentiations, especially the unique cultural expressions that once were generated from such differentiations, are gradually homogenized now. In other words, the current formal manifestations of S. A. do not represent their cultural context very well, resulting in a loose spiritual connection with their location. A new framework of S.A. needs to be developed, one which focuses on incorporating cultural elements into the design process, thus repairing the link between S.A. and the local context.

The author is convinced that it is crucial at this point to adjust the balance between function (energy performance) and form (cultural expression) in

sustainable design for a long-term benefit. The ultimate purpose of this timely appraisal is to help sustainable architecture re-evaluate and regain its formal expression, by using buildings' formal expressions to highlight correct attitudes toward environment, which cannot be replaced exclusively by functional considerations of buildings. Architecture, as a communicative space between human beings and nature, has the power to persuade its speculators of sustainability wills. It is the pioneer and builder of human societies --- architects convey such a will to the public through their buildings. Through these means, architecture can become a site for sustainability education, and a symbol for the benign of our dwelling environment. The public would be educated and influenced, and ultimately we would retrieve a harmonious relationship with nature. All of this cannot be realized without the cultural expression of S.A. In a word, a true S.A. must correspond to both the natural and cultural environments; the latter one will become the focus that requires for more effort in future practices.

CHAPTER 2 BACKGROUND REVIEW

Environmental Movements

A concern for our environment is evident throughout human history. Environmental recognition grew more rapidly over the course of the last century than in any others; more people realized that we have to put much more effort in restoring and protecting our earth, for various kinds of human activities have caused aspects of our environment to reach the limits of sustainability. Human activities have resulted in a series of global environmental problems, including global warming, land degradation, over-population, fresh water scarcity, air pollution, toxin proliferation, species extinction and others (Kaplan 44-46). As a result of the environmental movements formed in the 1960s, these phenomena have received more and more attention. In the sixties, a realization emerged that the rapid population growth would increase pollution, thus affecting our environment. A related concern was that energy consumption was climbing up to new levels because the lifestyle in Western society was increasingly materialist and consumerist. Seeking a solution for growing energy consumption eventually became the research focus for some professionals. For instance, in his popular book, *Direct Use of the Sun's Energy*, Farrington Daniels discusses the potential uses of solar energy.

In the 1970s, the global oil crisis alerted us once again to the possible catastrophes that the energy shortage may bring to western society. An awareness of the inter-connection among population, development, consumerism, and resource depletion was beginning to form. In the 1980's, a "deep ecology" movement sprouted, which espoused the cultivation of life in harmony with biotic communities, and the establishment of a lifestyle alternative to the materialistic and consumer-driven forms of Western capitalism. The word "deep" refers to the questioning of the fundamental root causes of the environmental problems. John McCormick, in his book *The Global Environmental Movement*, analyzes the roots of the environmental crisis in the ideology of industrial society, which he defines as "a coherent ideology which includes a faith in science and technology, the subjection of nature and its exploitation as a resource, and above all, a deep commitment to economic growth by the government" (Cotgrove 29: Nature). According to McCormick's assertion, those who are raised in such a cultural atmosphere are "markedly less likely to perceive environmental dangers, and markedly more likely to believe that market forces and science and technology will provide solutions." (Cotgrove 29: Nature)

Hence, the proponents of the "deep ecology" movement were convinced that to save our world, we must make fundamental changes in our basic (cultural) values and practices (Drengson), which requires a reappraisal of industrialization and modern civilization, and aspires to a new social value. In contrast to "deep"

ecology, “shallow” approaches would not solve the problem because they focus only on promoting technological fixes to environmental problems, such as exploitation of renewable energy and increased automotive efficiency. Stephen F. Cotgrove in his writing indicates that such technological approaches cannot solve all environmental problems, for these technologies are based on the same consumer-oriented ideologies and the values of industrial economy. Instead the worldview of the whole society needs to be changed as well (Cotgrove 10).

As a result of these movements, environmental concerns were accepted as a fundamental issue for the whole of human society, and have become more and more rooted in people’s consciousnesses. More remarkably, the human societies started increasingly to recognize the inadequacy of the “technocratic” paradigm¹ with respect to long-term sustainability.

Brief Review on S.A. Design

Directly corresponding to the environmental movements of the sixties, Sustainable Architecture is a trend that emerged which shows a profound respect

¹ Technocracy is a term borrowed from Alan Drengson’s article, “Shifting Paradigms: From the Technocratic to the Person-Planetary”, *Environmental Ethics* 2 (1980): 221-40. The meaning of “technocracy” has different interpretations in academia. But generally, it can be understood as a system that is governed through use of technology/technological prowess. A “technocratic” society relies for its development on technical achievement and thus consider it an issue of central importance.

for the environment. According to Brian Edwards and Chrisna du Plessis' review in Architecture Design, such a design theory that shows particular attention to the natural environment can be traced back to the 19th century, to predecessors like John Ruskin, William Morris and Richard Lethaby, who worried about industrialization and attempted to insert natural order and harmony back into architecture (Edward 9).

Ruskin had a deep affection for nature and the harmonious order in the natural world. In his book *The Stones of Venice*, he expresses his belief that art, nature, and human morality are inextricably intertwined. Therefore, when he saw that industrial pollution and the menace of urbanism were disturbing the natural order and ruining the rustic countryside, Ruskin viewed these as signals of human depravity. In one of his Letters to the Clergy on the Lord's Prayer and the Church, he gives evocative descriptions: "The smoke of their (the cities) sin going into the face of heaven like the furnace of Sodom; and the pollution of it rotting and raging the bones and the souls of the peasant people around them". He also demonstrates his promotion of consistently responsible design for the future generations by saying: "when we build, let us think that we build for ever. Let it not be for present delight nor for present use alone" (Ruskin, VIII 233-234).

Morris, the leading member of the Arts and Craft movement, was also a "biophilic" (Taylor), who devoted much attention to the environment. Angus

Taylor remarks that Morris' most significant contribution to environmental ethics is through the demonstration that "the project of improving human life through conquering nature is incoherent because human well-being cannot be divorced from the well-being of the natural environment". Like Ruskin, Morris also alerted us to industrial society's destructive effects on nature. Morris advocates a return to a rustic lifestyle, accompanied by an abolition of large-scale industry and towns. He is convinced that by these means nature could then be able to "recover from the destruction wrought by humanity, and humanity will recover its sense of oneness with the natural environment" (Taylor).

Lethaby, another key member in the Arts and Crafts movement, emphasises the combination of individual creativity and mechanical mass production (Farmer 96), by which he intends to connect the ideologies of Ruskin and Morris with more modern construction methods (Farmer 94). He recognises that architecture should "demonstrate how mankind could live in harmony with nature" (Farmer 94), rather than dominating over it. Through a metaphorical design style, he attempts to restore a culture that is capable of achieving a spiritual union between humanity and nature. Thus, at the end of the 19th century, when these environmental mavericks witnessed the harmful consequences of industrialization, many of their suggestions were largely in tune with today's sustainable strategies.

Earlier in the last century, organic architecture, represented mainly by Alvar Aalto in Finland and Frank Lloyd Wright in America, presented a strong argument against the doctrines of the then dominant International Style (Farmer 130). In spite of the varied styles between these two masterful architects, the essential spirit in their designs has a close connection with both the local climate and cultural traditions. Their design philosophy received a profound influence from the Arts and Crafts movement (Farmer 133), for whom natural forms acted as important sources of inspiration. For instance, Wright designed the columns in the Johnson Wax Building to simulate the structure of lily pad, and the spiral ramp in Guggenheim Museum mimics the shape of seashell (Farmer 134); Aalto, in Villa Mairea, for example, used metal columns with rattan to remind spectators of birch trees (Farmer 135). Both architects' buildings were harmoniously merged with the site, and displayed an intimacy with the natural surroundings. According to John Farmer's observations, Wright had exceptional talent in siting a building. His arrangements for the whole site do not use a human-built object to dominate the location. Instead, he incorporates the landscape with a great effort and thus sets the natural surroundings not only as a backdrop but also a constituent element of the building (Farmer 134). Aalto's uniqueness lies more in his extraordinary reinterpretation of the language of International Modernism into a dynamic style that always shows respects to both natural and cultural contexts. "Harmonious", "unified" and "assimilation" are the words he frequently uses to

suggest the importance of the fundamental unity between human beings and nature.

In the 1960's, the International Style had gone through plenty of variations and developments from its earlier stage, while a new generation of environmental design started to emerge. Archigram of the early 1960's "sought a distinctive reconciliation between high technology and environmental problems" (Edward 10), which is demonstrated by Ron Herron's conceptual design entitled "Walking City, NY". This design has a dynamic format that responds to and interacts with the available nearby natural resources: the legs of each dwelling unit enabled the building to move around in search of water, sunlight or other sources of energy. The Walking City, with its machine-like appearance, was an updated version of Le Corbusier's "machine for living in" (Farmer 193). Human beings not only live in this imagined city, but are assimilated into the buildings. By breaking the conventional relationship between the city and its natural environment, people would have much more freedom to choose their habitation. However, even though the concept of this movable city was driven by the environmental concern that reflected humanity's persistent pursuit of better dwelling conditions, it was also a dangerous signal to the society: with the assistance of modern science and technology, human beings would be able to discard their current living environment and look for a new one.

In the 1970's, a group of British architects embraced Buckminster Fuller's theory of sustainable architecture, based largely on "high-tech" solutions with refined technological flexibility and efficiency. Fuller was an important contributor to the strain of technology-oriented environmental ethics. He had a wide range of knowledge in mathematics, physics, and engineering, which explains his belief in the power of science and technology. To his mind, technology had been bringing radical changes to human society and will continue to do so, which lead him to espouse design principles that maximizes technology in order to reduce waste and pollutions. His legacy motivated the high-tech design trend, and he became its guru-like intellectual inspiration.

High-tech architecture should be considered as a movement rather than a particular style that is typified by its high concentration of radical technology employed to environmental ends. Not only pursuing a design of pure functionalism, high-tech architecture projects a rooted ideological belief in the power of science and technology. It reinterprets the engineering aesthetics of Le Corbusier. The difference is that while Le Corbusier "built the houses that were technologically primitive and looked nothing like machines", while high-tech buildings "do look like machines" (6), Colin Davies contrasts the two in his High Tech Architecture. Meanwhile in this book, he identified that high-tech architecture first appeared in the early 1970's (6), but Brian Edwards and Chrisna du Plessis assert that it wasn't until till 1990's high-tech architects have managed

to embrace sustainability in their practices (10). The pursuit of radical technology dominated the ideology in the early stages of sustainable architecture. Its focus was on the qualities of the structure, the construction details, and new materials. Its proponents constrained the endeavour largely to economical and efficient approaches, which philosophy was believed to encourage energy conservation as part of the environmental agenda.

Since then, energy issues have become an overwhelming consideration on the stage of the sustainable architecture enterprise. Professionals have focused their energies on the search for a clean and renewable energy, the reduction of energy consumption, as well as the development of low-cost tectonic materials.

From the preceding review on the development of environmental movements, one could quickly grasp that environmental awareness took place and developed mainly because of energy over-exploitation, shortages and pollution. In the early 20th century, the fierce expansion of industry seemed to overshadow the hopeful progress of an earlier environmental awareness advocated by Ruskin and others. Although keen professionals started to research new types of energy, the excess energy consumption was not extensively noticed until a series of crises happened, such as the 1965 blackout in New York and the oil crisis in 1970's. Because these events were closely

connected with daily life and economic activity, the public received a much stronger signal than ever before, indicating not only the shortage of natural resources, but also the disturbing condition of the entire natural system. The acknowledgement of environmental problems, focused primarily on energy issues, was thus promoted in a social extent. As large energy consumers, the architecture and construction industry have inevitable responsibilities to minimize energy expenditure and waste as much as possible. "50% of material resources taken from nature are building-related. Over 50% of national waste production comes from the building sector. 40% of the energy consumption in Europe is building-related" (Anink 8). Such expenditures of energy have attracted more research and engagement than any other concern in the field, and consequently, the concern over energy has become an issue most, if not all, architects will have to engage with.

Moreover, according to the author's observation, there was another possible reason that eventually drove the development of S.A. into technology-focusing decades ago. Even the "deep ecology" movement of the 1980's has recognized the underlying problem is the cultural content calling for conquest and domination over nature, the approaches to change such a culture were mostly remained in seeking political solutions. Through the agreements signed on the summit meetings and the domestic legislations, environmentalists tried to direct the sustainable development by political guidelines, and thus transform the socio-

cultural climate. In consequence, the task of reforming an environmental-friendly culture has been less concerned by architects, rather they left the consideration to socialists or politicians.

Since the 1990's, new technologies provide a new vision for this field. For example, the power of information technology is embedded into AI control systems which are able to quickly react to dynamic situations, such as the position of sun, wind velocity and other variable climatic conditions. All data are collected by sensor units and then conveyed to the controlling implements on roofs and façades. By these means, the building is ensured of the best physical performance at all times.

However, criticism concerning this technological orientation in S.A. also has been raised for its subtle reinforcement of the scientific domination over nature and the discarding of cultural contexts. John Farmer, for example, criticises the “emphatic technological expression” of such high-tech design solutions because they “implicate the building with the very problem that underlies the environmental crisis” (Farmer 2006). The method that technologies are used in the majority of present S.A. design is repeatedly exceeds the natural orders and thus constitutes a triumph over nature. However, to those architects of the Arts and Crafts movement, and those of organic architecture, technology was not an obstacle to creating a harmonious relationship between human and nature. As a matter of fact, none of these architects were opposed to the

development of technology per se. Some of them aspired to an Arcadian life because of their critical concern of the long-term consequences of industrialization and urbanism. For example, Farmer describes Aalto as having “been excited by the machine and by the history of technological invention” (136). But his appreciation of technology did not prevent his design from uniting rural surroundings by mimicking natural forms in Villa Mariea; nor did it hamper his presentation of Finnish nature and culture in his winning design for the Finnish Pavilion. In his architectural creations, the connection of the physical and psychological with particular forms of nature and culture come from his vision of technology, which “should be humanized through its relation to nature” (Farmer 139). However, current S.A. has difficulties in recognizing and realizing the importance of such a “humanization” of technology.

Moreover, the universal application of high tech materials and equipment makes S.A. lost the indigenous connection with its environment. “As representative of a particular aspect of a particular culture at a particular time” (Hagen 91), materials in architectural design have their symbolic or representational meanings. Architects create meaningful forms by embracing, arranging and transforming building materials. Such symbolic meanings are projected through the qualities of material, such as mass, material surface or texture light, space and time. That is a fundamental language in architectural design. The materials in high tech architecture, however, only have the technological implication. They are synthetically manufactured in factories and

can be delivered to every corner of this world. By simply looking at these materials, such as glazing metal, laminated glass or PV cells, one cannot tell where they come from or be reminded of any particular cultural background. Undeniably and inevitably, the globalization shortens the distance of space and time on this planet whereas increases the difficulties to interpret the discrepancies of various natural and cultural context of particular locations. The developed and developing cities have demonstrated homogeneous phenomena in architectural appearance in a global range, which is a tough topic not only limited to S.A. architects. The author is not trying to advocate any return to primitive materials in construction, but to reappraisal the present materiality in high tech S.A. design: whether such employment is of some metaphorical or symbolic purpose, or only as the embodiment of technology; whether the design merely shows “the interest in the signification of building materials”, or “their environmental implications” (Hagen 91).

Any building exclusively employing technological doctrines will impossibly avoid losing its identifiable features, like the sense of space, time and function, all of which have been replaced by energy concerns. Even though a building may have achieved an optimal energy performance, the lack of cultural and aesthetic value make it merely a crafted machine rather than a piece of creative work.

Fig.1 Villa Mairea.
Designed by Alvar Aalto in 1937 to 1938. The house stands in the middle of a pine forest at the top of a hill in Western Finland. It looks like a continuous unbroken stretches of forest.

Fig.2 Fallingwater. Designed by Frank Lloyd Wright in 1930's. The platforms over a small water fall becomes the symbol of this prairie house. The building is blended with the site harmoniously.

Fig.3 Walking City, NY.
Designed by Ron Herron in 1964, as a member of Archigram. The Archigram collective proposed prefabricated removable units, exposed service elements like utilities and mechanical systems, and replaceable interior structures.

Fig.4 Lloyd's Building.
Designed by Richard Rogers from 1979 to 1984. It represents the high tech design style that emerged in 1970's.

CHAPTER 3 THE MEANING OF SUSTAINABLE ARCHITECTURE

Defining S.A.

Architecture can be defined differently from various perspectives. The definition in Chambers Concise Dictionary is: “1) The art and science of designing and erecting buildings; 2) Buildings and other large structures; 3) A style and method of design and construction”. In this paper, especially with respect to the definition of S.A., “architecture” will refer to structures built with concern both to their functionality and aesthetic effects.

Sustainable, or sustainability, comes from the verb sustain, which means “to hold up; to bear; to support; to provide for; to maintain; to sanction; to keep going; to keep up; to prolong; to support the life of” (Chamber Concise Dictionary). Generally when using the adjective “sustainable” or the noun “sustainability”, we actually imply three possible meanings: sustainable development, sustainable growth, and sustainable use: “Sustainable growth is a contradiction in terms: nothing physical can grow indefinitely. Sustainable use is only applicable to renewable resources. Sustainable development is used in this strategy to mean: improving the quality of human life whilst living within the carrying capacity of the ecosystems” (IUCN). These three subdivided meanings constitute the connotation of the terms “sustainable” and “sustainability”.

“Sustainable architecture” is becoming a frequently used word in the media, and it is replacing all the other names used for this certain kind of

architecture, which was once called “green architecture” in John Farmer’s Green Shift; and also named “ecological architecture” in other literature. Sustainability becomes a vital issue that always causes debate and has been applied to almost every discipline. Based on the original meaning of “sustainable”, “sustainable architecture” would then refer to a certain kind of architecture that is able to maintain or prolong our existence on this planet, despite the global environmental crisis humanity is facing. Its design rationale concentrates on the influence that industry could have on our environment. An essential aspect of this kind of architecture is harmonious interaction with the environment rather than confrontation. Ultimately it aims at helping restore the relationship between humans and their environment. At this point we can vaguely conclude that sustainable architecture is environmental-friendly buildings. But before any further discussion on designing sustainable architecture, a concept of environment needs to be clarified, since it is the premise of sustainable architecture.

Defining Environment

When we talk about the “environment” that humans dwell in, what exactly do we mean by this word? A quick explanation from the dictionary: Environment: 1- physically, “everything that surround us”; 2- biologically, “the condition under which any person or living thing lives or is developed; the sum total of influence

which modify and determine the development of life or character” (Compact Oxford, 880)

Looking around, we may see the environment physically surrounding us --- trees, rivers, other animal species, and all kinds of beings and phenomena that have existed before human beings’ emergence on this planet. In this thesis, the collection of these existences or elements even before human’s emergence will be regarded as “nature”. In addition to nature, we can see the buildings in a far distance of this city. There are another kind of physical beings that created by human, such as buildings, streets, farms and so on. If we were to limit the concept of “environment” to only the material, then the new definition could be stated in this phase: environment has two subordinate components, natural and human-made. Nonetheless, let’s step forward and examine the power source behind the diversity and complexity of human-built objects. What makes the appearance of our shelters or the places we gather together so different from what human beings used in Neolithic Age? The answer is the unique intelligent ability that humans have, with which we form cultural phenomena in human societies. Indeed, culture is a difficult term to define. In 1982, UNESCO, at the World Conference on Cultural Policies, introduced this description of culture:

“In its widest sense, culture may now be said to be the whole complex of distinctive, spiritual, material, intellectual and emotional features that characterize a society or group. It includes not only the arts and letters, but also modes of life,

the fundamental rights of the human beings, value systems, traditions and beliefs.”

Culture is a total pattern of human knowledge, behaviour and its products, embodied in artifact. It can be learned and transmitted to succeeding generations through language and systems of abstract of thought. Compared to other creatures on this planet, human beings are the only specie with their own culture. It is not static, but rather always developing. Since the first permanent settlements in Neolithic Age, human beings have always been striving for better living conditions by using their cultural achievements composed of all the knowledge and information accumulated from daily life. Human beings use their intellectual effort in the process of conceptualizing and improving upon our built environment. Regardless of the time or style of the built environment², the cultural value of human society is reflected. Therefore, environment, in the discussion of sustainable architecture, is natural-based and cultural-constructed.

The Blurred Boundary Between Nature and Culture

² “Built environment” and “architecture” in this thesis have similar but subtly different meanings. Built environment includes architecture, and all the human-made constructions such as roads, artificial landscape etc. When using “built environment”, I am trying to accentuate the entire entity, the whole group; when using “architecture”, I specifically mean the individual buildings that are not merely “constructions”, but contain also aesthetic value.

In all environments, however, the division lining between these two realms — nature and culture — is not distinctive. The intellectual character³ of human beings is a crucial element in constitution of diverse cultural formulations. This character is defined in Quatremère's treatise as "the energetic and pronounced indication of habits which each species has received from the beginning" (Palma 47). Also, he identifies it as a result of environmental influences. In the history of Western thought, the impact nature has on human's cultural development is one of the three constantly appearing questions that inquiry the relationship of human, culture and nature (Glacken Preface vii). According to John Locke, human beings use their *sensation* (touching, hearing, and seeing etc.) to interact with the objects in surrounding environments, and use their *reflection* to contemplate the previous operation (Palma 47). Locke's articulation explains the difference in cultural phenomena between human groups of varied locality, thus setting up a close connection of culture and nature. Nature is "the fundamental issue to be considered when discussing culture and cultural productions," because it "influences culture, not the other way around" (Palma 47). Therefore, from the beginning, culture, even though it is created by human intelligence, is also sculpted by nature at the same time.

Thus, culture shows its fastened relation with nature, and even after culture has its own separated identity, this pair of binary concepts still is closely

³ According to Quatremère's article, character is divided into two types: physical or visual, and moral or intellectual. This paper limits its consideration in the latter one, and regards intellectual character is basis of the formulation of diverse cultures.

connected. Hagan is convinced that “our cultural constructs of nature ... encourage or inhibit various behaviours towards it (nature)” (Hagan 18). The “cultural constructs” that Hagan mentions means the way humans describe nature in different disciplines, such as mathematics, physics, philosophy and so on. Thus, people get to understand nature through culture. From the press and media, one is informed of the dangerous condition of our environment; by researching in library or being educated in school, one starts seeking solutions for healing the wounded natural world. In other words, “only the cultural constructs of nature are truly knowable” (Hagan 17). Our culture, which is “knowable” to us, determines how we position ourselves within nature, how we define the relationship with nature, and what attitude should be held towards nature.

The purpose of all the discussion above is to establish a concept of “environment” to serve as a context for a further discussion about S.A. The conceptive formulation of S.A. was initially due to the tension between the humanity and their environment, and the effort of proposing solutions from an architectural perspective. Therefore, a comprehensive research on the connotation of environment would be helpful for us to clearly identify the problem and find out solutions. Human environment for human dwelling can be divided into two types: natural and cultural. Both are indispensable for human beings’ existence on this planet. Without nature, human beings would lose the most basic physical resources to sustain their life; without culture, human beings would

not be identified as human, because spiritual pursuit and complex productions mark the fine line distinguishing us from other creatures. The relationship between these two types of environment is complicated, weaved and folded into each other, ever since the beginning of human civilization. Any attempt to try to explicitly distinguish these two types is not only difficult, which is also unnecessary in some degree. The importance lies in the reorganization of how they are relevant to each other, their relative independent and inter-dependent relations.

CHAPTER 4 ARCHITECTURE: THE MEDIUM BETWEEN NATURE AND CULTURE

The Influence of Nature

Architecture, as a physical expression of culture, inevitably has to receive nature's influence. Continuing with his argument of nature and human character, Quatremère already set up such a triangular connection: "nature has an influence on nations, nations have an influence on individuals and individuals have an influence on the arts, the arts cannot help but receive a more or less direct influence from the natural environment in which they are situated" (Palma 49). Discussing the genesis of architecture, Quatremère's "three primitive forms" theory presents a clearer link to specific natural environments, contrasting with Laugier's wooden-hut-genesis hypothesis. Quatremère asserts that there were three different types of architecture according to the primitive living conditions of human beings:

- . Caves, used by hunters and fishers "who find their shelter where they can ... whose character was heaviness"

- . Tents, used by herders "because of their nomadic life", whose character was lightness

- . Wooden huts, built by farmers, for their settlement is permanent, whose character was firmness (Palma 49)

Natural patterns decide the living methods of humans; their living condition leads to a certain architectural form accordingly. What also has been implied out of Quatremère's examples is that architecture does not merely depend on nature, but on human culture as well. In his own words, "the character of the architecture of different people consists in ... a configuration determined by physical needs and moral habits" (Palma 49). The terms Quatremère uses — "physical needs" and "moral habits" — essentially are a set of different narration of nature and culture. Human's "physical needs" are determined by human instincts and the living materials his/her natural surroundings can offer. The "moral habits" represent the ethics of human beings, establishing the cultural value.

Fig.5 M.-A. Laugier introduced primitive hut as an embodiment of his advocacy of geometric purity and selective application of classical elements. The origin of architecture demonstrates the clear structure and formal expression.

Architecture As Media

The primary function of architecture is to shelter us from nature. Although all buildings in cities have different service objectives — school for education, hospital for health care, factory for manufacture — their most basic purpose for us is to construct physical shelters. It is a simple fundamental purpose, but it decides the role of architecture acting between human beings (and their culture) and nature: a medium and communication place.

The position of architecture in the culture/nature binary is fairly interesting. As mentioned in the last paragraph, architecture is the physical expression of culture. Nevertheless, if we look forward to see what cultural source has been nourishing architectural form, we would ultimately see nature's traces: "The man-made world is ... born as a human reflection of the wonder we find in the natural world – the heavens, the seasons, landscapes and seascapes, plants and animals" (Crowe 7). Imitation of nature is a motif that constantly appears in architectural design, throughout the Greek and Roman Times, the Middle Ages, the Renaissance, the Industrial Age, and even in modern movements. Although Kant argues that "the built environment is merely a concrete manifestation of culture" (Kant 274), we consider the indirectly influence from nature a concealing but powerful factor. The reason is that the main subject in this paper is about sustainable architecture that has an exceptional responsibility to nature.

Architecture's Reaction to Nature and Culture

Based on the argument that architecture receives influences directly and indirectly from nature and culture, our focus now is how architecture reacts as receiving those influences?

On Natural Environment:

The impact architecture has on the natural environment is obvious: cities sprawl into nature, and buildings take up natural material; tectonic materials come from woods or mineral resource; used air or water from buildings will be drained to natural bio-systems. Architecture pressures its natural surroundings. After human beings have permanent settlements, the built environment and its natural surroundings have a stable connection. Human groups constantly demand resources from the nearby natural environment for living resource. In a micro view, built environment is bound with a particular locality. These requests may be affordable to nature, or may not, depending on the quantities and the approaches.

In 1987, the World Commission on Environment and Development defined "sustainability" as the "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Conte 11). For future generations the reality is that there will be no more virgin land on this planet left for exploration and exploitation. That is to say, the environment for human dwelling is a fixed quality. This world is like a mini bio-system in a closed

glass sphere⁴. Within the limitations and boundaries that have been set up, sustainable development is entirely self-reliant without any help from outside. Humankind needs to balance the fragile and delicate environmental system carefully so as to survive. But meanwhile, human society and civilization still need growth and progression. Pragmatically it is not possible for all populations to abandon contemporary techniques and technologies and move back to a pre-industrial or pre-urban state. Moreover, our society and civilization will continue moving towards a higher level, as it always does. Therefore, inside this sealed environment, the balance between nature and culture must be maintained with extreme carefulness, almost like the sealed glass sphere --- neither the golden fish nor the aquatic plants can dominate. If there are too many goldenfish, the aquatic plants are not able to provide food for all fish; whereas, if the aquatic plants occupy too much space, which leads to the fish's death, they also cannot live long without the nutritious substances from the fish.

Therefore, every step taken in the future must deliberately respect the potential for wide-ranging consequences, and developmental strategies must multi-disciplinary encompass with long-term considerations. S.A. should be part of the strategies by which the nature/culture balance could eventually be restored because of its dual position with respect to both sides.

⁴ A typical example of this kind of glass sphere is the fish tank containing golden fish, and aquatic plants. This small world is perfectly balanced: golden fish live on the aquatic plants; and fish's waste is the nutrition for the aquatic plants growth.

S.A. shall establish a new relation with the natural environment.

Throughout the entire architectural practice, from the schematic stages to construction, till the buildings are open to use, architects should consistently be considering how to decrease the negative impact on natural systems. The “negative impact” refers to the disturbing or damaging consequences caused by human’s activities, such as excessive energy consumption or inappropriate waste disposal. All these actions will increase the burden on nature, preventing it from being part of a balanced efficient and functional system. The HOK design group is an eminent member in S.A. design community. In their guidebook for sustainable design, they specify that “to harness natural energy flows and biological processes, eliminate reliance on fossil fuels and toxic materials, and improve resource efficiency”(Mendler 6) are the keys to maintain the “interdependent relationship” between built and natural environments. Therefore, the current focus on creating a “harmonious” relation with nature is essentially centred on energy conservation.

After about half century’s effort, we have made great achievements in broadening energy type, converting energy flowing model, and formulating durable and recyclable materials. But the most important achievement has to be awarded to the “energy flowing paradigm”, which shifts from linear consumption to circulation. Circular mood tremendous increases energy efficiency by recycling the end-waste and transmit it to start-source. Lead by such ideology, a set of changes occurred. Firstly, renewable energy has

occupied a considerable portion of the whole. Upgrading from the conventional energy source, more and more buildings that employ renewable source is emerging, such as geothermal, wind, solar and hydropower etc. Although implementation of renewable energy in architecture is not a new invention to human society, with modern technologies' help, by improving the approaches in generation and collection, not only does renewable energy expand its realm, but also more becomes a kind of reliable, effective, and efficient modern energy source. When making these construction materials, human uses energy to refine or shape the raw material into a desirable one. In this sense, we could regard the energy has been stored in material manufacture. Therefore, after construction or demolishment, if we throw them away, then the energy stored inside would be of no use. Rather, keeping all these waste material or debris in economical recycle operation, thus they could re-attain their value with respect to human being in a different form.

Fig.6 Energy Consumption Model. Redrew according to Hertbert Girardet 's illustration.

On Cultural Environment

S.A. can reverse the negative impact on natural surroundings by decreasing non-renewable energy consumption, which decreases the pollution level. But what kind of relationship should exist between S.A. and human beings? How should S.A. respond to culture?

Architecture provides accommodation for humans. In the interactions between humans and nature, it is a critical space. Especially with the explosion of urbanization at the present, the opportunities for people to get in touch with nature are becoming fewer and fewer. In cities, the outdoor green space is planted with specific intentions; the “natural look” park is designed by landscape architects; few places have not been touched by human beings. The majority of human society in today’s world lives in a built environment. It is even said that if one chooses an urban life style, he/she will spend an average 70% of his/her lifespan indoors. Certainly, human interaction with the built environment has increased tremendously in the contemporary world. Its profound impact on human psychology and behaviour has been evidenced and is getting more and more significant. Individually, human beings are profoundly impacted by the built environment they inhabit. Such individual influence eventually will gather into a cultural influence at a larger social scale.

In earlier times, human characters and group cultures were mainly affected by the natural elements like climate, geographical features, or other species' location. Now, a long time after humans shifted from "man the hunter and gatherer", when major population of this world has adapted to either "man the farmer" or "man the urban dweller" (Crowe 35), architecture has gradually formed its own identity and started to be able to affect its "mother" cultural environment. For example, Las Vegas is famous for its consumptive culture, featured by gaming and entertaining activities. When this city was constructed, the architectural style was decided according to what urban culture it needed to serve. Therefore its colourful appearance, splendidly luxurious decoration, and picturesque visual effect at night all come from the city's particular cultural demands. So now if one were to think of this city, images of the neon-lighting buildings, grand interior and so on would be projected in his mind. But it would be hard to imagine this city keeping all activities, entertainments, and games, but renovating all buildings into dull, plain, mid-rise rectangle grey boxes. Is the city still able to give the tourists the same cultural ambience? The answer will be "No" for most people. Las Vegas' architectural form has become a symbol of its culture. Most of the time people take this symbolization for granted. Only when is it going to disappear, can people realize that architecture, as a crucial expression of our culture, can also determine the existing formations of culture. If the characteristic of architecture agrees with its cultural environment, cultural features will be enhanced; if not, then culture feature will be weakened or even demolished.

Though historically culture and nature had a mutually dependent relationship, the situation today is more of opposition. Especially in Western culture, the expansion of the built environment is based on an idea of conquering nature. The ultimate objective of S.A. is to reinstate a balanced relationship and to express a new view of our environment. At this moment, a brief review of how human beings understand nature throughout different times, and their corresponding architectural styles will help us locate the turning point in the timeline and realize what has led our culture into a hostile position vis-à-vis nature.

Fig.7 Night view of Las Vegas. Its night is decorated by the glorious lights and neon signage. In his book Learning from Las Vegas, Robert Venturi emphasises the symbolization is a strong part of our culture. Architecture is an essential symbol to our cultural identity.

Looking Back

Greek and Roman Times:

The Greek and Roman eras can be regarded as an “enlightened” stage of Western Civilization. People of that time esteemed the earth as “Demeter”— a combination of the words “mother” and “earth” (Glacken 20). The veneration of “mother earth” is based on a simple fact: she provides everything humans need to survive, from various foods to protective shelter; she also does everything for humans just like a mother would. It is not only appreciation, but also a worship of nature. Through human’s direct observation, they are astonished by natural phenomena: the periods of moon, the seasonal changes, and the life courses of all beings. Therefore, they believe all these, including humans, are created by some divine power. To them, it seemed that there was some order behind all these creations. Analyzing the regularity of the heavens and the periodical cycle of all life, the ancient world was convinced that they were part of a unified cosmos. What humans had to do was to seek and understand this sacred order, and humbly follow it.

These thoughts fed a speculation that unity and harmony were the basic characteristics of nature. This belief is also reflected in their cultural productions. For instance, the cultural continuity of that time, as Glacken writes, was such that they “tended either to minimize their existence or to content themselves with generalizations about the period as a whole, citations in support of a thesis being

taken from writers who lived as much as a thousand years apart” (Glacken 13). The word “minimize” indicates the culture at that time was not self-centred. Their preliminary consideration was the whole entity. The individual unit existed to compose the whole, not to overcome the other components to become the “maximum”. Therefore, architecture of that time was not built to stand above the natural environment, but to dedicate itself to the landscape: “The landscape and the temples together form the architectural whole, and must therefore be seen in relation to each other” (Scully 1-2). They believed that certain natural environment had unique character that is closely linked to a divine spirit, distinguishing it from other places. Thus, ancient architecture “explores and praises” such a spirit, and “embodies the whole of the deity as a recognized natural forces” (Scully 2). Accordingly, people of that time claimed a profound spiritual connection with nature.

The ancient thus created the best buildings and art forms for their gods and goddesses who were guarding certain sites. In their designs, they followed the divine order— the golden scale was regarded as the best representation of the united root behind human beings and their natural surroundings. This order was brought by transcendent powers to the earth, so only by respecting and integrating it, would the god and goddess be pleased.

The Middle Ages

During the thousand-year-period between 500 AC and 1500 AC, it is not easy for one to generalize about all the varied thoughts and concepts about nature and their architectural expressions. Hence, the discussion will be focused on the influence of Christianity on the Western world, for Christian theology had a “unique and commanding position” in the Middle Ages, which lead to relatively “more unity of thought than in other periods” (Glacken 171). Guided by it, human beings attempted to interpret nature with a new perspective and carry out practices on nature with such a consciousness.

Human and nature were believed to be united under God — both are the creation of a God that endows them harmony and order. Also human beings were aware of their active power, and the special purpose of nature’s creation. Human thought and practice on nature is not merely about the relationship between the two, but more importantly expresses a piety to God — through the love of nature, one comes to love God. Contrasted with a deceiving impression of these so-called “dark ages”, neither is there lack of the discoveries of the beauty of nature, nor the affection for it: “The Middle Ages, so often said to have little love of nature, in point of fact gazed at every blade of grass with reverence” (Glacken 173). The notion, as many modern scholarship articulate, that simply emphasises the theme of overcoming control over nature of this period is not precise. People of that time did not attempt to conquer their natural environment, although human thought that they were located at the top of the hierarchy of all

living creatures. Because people of that time also believed all the physical and intellectual capabilities humans have were “placed by God”, not “created by (human being) himself” (Glacken 236). Therefore, when an individual used these capabilities to adapt “benign nature to his manifold uses” (Glacken 236), he/she should always put him/herself in a humble position.

Nevertheless, what is notable is that “the love of nature” comes from the love of God. For example, Augustine’s view is that, “nature and the earth are creations of God, that they have beauty, grace, usefulness, that one should never lose oneself in them, worshipping them, and forgetting the Creator and the City of God” (Glacken 199). People believed that the responsibilities for the natural environment is a stewardship assigned by God, through which humanity may attain a better understanding of God. The natural environment, despite all the wonders and the beauties, is still very harsh and threatens human survival. But this defectiveness originates from the sin of human self as punishment, since the Fall from Eden. The reason that God created an imperfect and uncompleted world for human’s dwelling was to trial their intelligence and faith. Then through the process of managing the earth, humans are able to enrich their experience and knowledge, discover the truth, and eventually approach God.

All these thoughts and beliefs are reflected in architectural form: religious architecture is dedicated to the worship of God; whereas the secular architecture is constructed for a better living condition. The first Romanesque cathedrals

adapted a Roman basilica plan but changed the shape into a symbolic cross. With tectonic techniques developments, arched and ribbed vaulting replaced barrel vaulting, which styled Gothic architecture a wider expanse and an increased amount of light emblematic of God's presence. Decorations in "God's place on the earth" were to show God's word in the formal language of architecture, not in text, for a great people at that time could neither read nor write. Meanwhile, to fix imperfections of nature, extensive environmental changes were exerted: human beings assigned by God worked on those un-harmonious phenomena. Therefore, architecture attempted to revise the buildings within a logical rational order. For instance, castles built from huge pile of stones became to elegant structure with a well-organized function.

The Renaissance

In this period the belief of human as modifier and manager of nature was widely accepted and well clarified. Such a consolidation was largely assisted by the development in the science and art fields after the rediscovery of classical antiquity literature, especially Vitruvius' Ten Books on architecture.

Continuously with the Middle Ages, people still viewed themselves as allied with nature under God. However, the revived interests in Greek and Roman texts generated a new interpretation of nature. Alberti says "our ancestors learned through observation of Nature herself ... Among the odd and even numbers, some are found more frequently in Nature". Those numbers

found in nature are not accidental. With the development of natural science, human beings started to look at this world in a systematic and objective way. People believed in the order of God's creations, which shared the same basis for reality: mathematics. These laws were considered immutable and universal. If the proportional concept in architectural design approached the order in natural world, then it should also be objective and universal. Nonetheless, the classical order from Greek and Roman times presents "disconcerting variations and inaccuracies, as well as a remarkable variety ... among different observers" (Crowe 97). To unify such discrepancies, Renaissance thinkers valorized the proportion of human body, which manifested the cosmic interconnection between human beings and nature.

Consequently, buildings were designed and proportioned according to the human body. In this manner, the relation between part and the whole was able to be kept logically and consistent. The elements of buildings "are systematically broken down into constituent parts so that the smallest unit can be designed with relation to the whole work of architecture" (Crowe 172). For instance, a building can be divided in a symmetry composition of the human body where each part of a building can be divided according to the ratio of human body parts.

The Modern Times

With the establishment of modern science, which is usually associated with a series achievements made by Galileo, Bacon, Descartes and Newton,

human beings changed their view of nature from a mythic or religious perspective to an objective and analytical attitude. Through mathematical formulation, nature is considered a machine-like operation running according to precise rules. Using these rigid mathematical disciplines to interpret dynamic natural phenomena, such as the life process of all kinds of creatures, human beings had a view that nature is a functional machine without spirit. It becomes a lifeless subject for researching and studying, a source of material provision for human beings. The separation of nature and culture is based on the vision that nature is objective whilst culture is subjective. Nature is not made by humans, in contrast to culture, which is of human origin. Although science remains a way of understanding the natural world, the character of science has changed from understanding the existential meaning of things and thus gaining wisdom, to pursuing the triumph over nature and thus exploiting its resources.

This revolution in the cultural field distances human being's intimate connection with nature, by replacing organic explanations with mechanical interpretations of all the things happening around us. Through all the achievements of modern science, humans believe they can find scientific explanations for all mysterious natural phenomena sooner or later, from the movement of heavenly bodies to complicated weather patterns. All this knowledge endows humans with an utter confidence in the face of nature. Accordingly, architecture also shifted from modest constructions showing their intimacy with nature or piety to God, to expressions of arbitrary relation. Here,

“arbitrary” means devalued or neglected. Architecture, as a production of a human intellect that has discovered and mastered the laws of nature, doesn't need to compromise with its natural environment. Such an attitude is primarily demonstrated by the use of technology to triumph over the natural order. For example, someone would consume large quantity energy for a “glass-box” house in a deserty climate in order to keep a comfortable temperature; or in the high density cities of Asia, governments are pouring millions of tons of soil into seashore in order to expand land area to accommodate the booming population. But neither of these is mandatory situation. Alternative solutions that use less energy or cause fewer on neighbouring regions are absolutely possible. With the help of modern science and technology, however, natural laws have been violated, as an apparent expression of human will.

Conclusion

The above review demonstrates that architecture, as an object created by human beings, has been molded by their knowledge and perception of this world. Along with the changing relationship with nature, architectural design has reflected the cultural character of different times. A fundamental conception is the relationship between nature and culture. This defines how humans understand natural phenomena, how humans define the function of nature, and what kind of operations humans believe they are able to place on nature. Every time these views were modified in the past, architecture was reformed accordingly to represent and espouse the new design philosophy.

As Kenneth Haggard, an architect of San Luis Obispo Sustainability Group, has pointed out, our society is moving from an industrial world to a sustainable world, as it moved from a nomadic hunting order to an agricultural order. During this changing process, S.A. should help to establish a new culture that embraces nature rather than dominating it. But to accomplish this objective, S.A. is facing plenty of challenges. The greatest one comes from the questioning of its economic value — whether the expenditure in S.A. is worthy? — which has been asked a lot in the reality of this industry. Economic profit has become a prevailing standard in this capitalized world. Some people judge everything based on its economic value. But how could the commercial market to price the arts, the ethics, or the cultures. It is true that artistic works can be traded as goods in the market with price tags, yet the prices could possibly represent their values to the humanity and the contributions to the civilization.

Anthropologists view culture is human nature. All people have a capacity to classify experiences, encode classifications symbolically, and pass such abstractions onto others. By this means, culture could be perceived and spread within a group of people. This is also S.A. is going to promulgate a new sustainability culture to society. To those who are not environmentally aware, S.A. can be an important educational tool; even to those who have realized the importance of the protection of natural surroundings, S.A. will manifest a balanced proportion between technology and other cultural considerations, such

as aesthetics, history, and social factors etc. in architectural design, which is believed to be an ultimate solution for the architecture profession to harness the material obsession of human beings, can also restore the harmonious relationship between humanity and nature.

CHAPTER 5 TWO CASE STUDIES: NORMAN FOSTER

Sustainable Architect: Norman Foster

Norman Foster, one of the world's most successful and highly regarded architects, has been engaged in environmentally sensitive design for decades. The collaboration with Buckminster Fuller started in the late 60's, had a profound impact on Foster's favorable view of technology. As a result of such inclinations shown in his design work, he was cataloged as one of the four leaders in high-tech movement together with the other British architects including Richard Rogers, Nicholas Grimshaw, and Michael Hopkins (Davies 6). Foster is always eager to employ the newest techniques and tectonic approaches in his designs. Observing the project list of his studio, one will notice a technological progression from futuristic, streamlined or mechanical looking buildings.

Also, his significance lies in his leading exemplary role in retaining the theory of environmental ideology into actual physical manifestations. From the earliest stages in his practice, Foster has shown a great willingness to cooperate with the natural environment, for instance, in Creek Vean House and Retreat (1964-1966). This half buried house with a landscaped roof was constructed with traditional warm-colored materials. Even without much installation of industrial components that signified the technology level, the layout of this small project is

still quite harmonious with its steeply sloping site and the creek at the west end, from external and internal perspectives.

Overall, Norman Foster's design practices have been very close to the disciplines of S.A. that this thesis is advocating. He asserts: "the best architecture comes from a synthesis of all of the elements that separately comprise a building: from its relationship to the streetscape or skyline to the structure that holds it up, the services that allow it to work, the ecology of the building, the materials used, the character of the spaces, the use of light and shade, the symbolism of the form and the way in which it signals its presence in the city or the countryside [...] Successful, sustainable architecture addressed all these things and many more" (Foster, 14). His technological innovation and engagement with the local context are two of the main reasons why his designs are highly acclaimed by both amateurs and professionals, and the reasons for his over 40 awards honoring Foster and his studio.

However, some of his most ambitious projects completed in recent years have shown some defects gradually. Namely, despite having projects entitled S.A. Foster could not well balance the relationship between technological and cultural components. The reasons of such observations are complex. First of all, even though Foster has realized that a holistic consideration is the best means to implement S.A. design, he has not explicitly theorized the importance of the balance between his technological and cultural interests with respect to

systematic and synthetic environmental strategies. Hence, his enthusiasm for radical technology, which was formed in his early practice together with Buckminster Fuller, sometimes surpasses all the other concerns and becomes the privileged one. Moreover, in our society, architectural design is a complicated business that involves clients, government officials, professionals, and the general public in some cases. It always involves a compromise that does not exclusively comply with the conceptions of the architects. If the other factions in this relationship have a misunderstood conception of what S.A. means, the final achievement of the architectural design will be flawed, or even tend toward the unsustainable.

Therefore, although Foster's design works are generally considered S.A. because of their focus on energy saving techniques, not all of them can be qualified as such. The following discussion is going to contrast two of his works: the new German Parliament and the London City Hall. These two projects have been constantly mutually referred, because of their similar exterior appearance, their identical spiral ramp, their similar political symbolization, and of course, the incorporation of radical sustainable technologies. These outward phenomena also have earned these two buildings the description of "twin" and "cousin" in some articles.

Beyond these apparent similarities, however, their differences are more important to a discussion of S.A., so this thesis will focus on the investigation and

analysis of them. As discussed above, S.A. is vital approach to prolong and enhance human's habitation on this planet, and must be responsible to both cultural and natural environments that substantially decide the quality of human dwellings. Therefore, an essential characteristic of S.A. is the absence of rigid style, or standard design, because the "environment" is different in every scenario. What S.A. advocates is to adopt the most appropriate design according to the particular climatic and geographic situations, and specific cultural and historical backgrounds. That is to say, no two sustainable designs are going to be the same — every S.A. is a unique design suited to its own particular context.

By looking at the city backgrounds, project backgrounds and design concepts, this thesis is going to analyze and interpret how the design principles were developed, and how cultural elements (which are mainly historical and political concerns in both cases) have influenced the design.

Fig.8 Sir Norman Foster.

**Fig. 9 Creek
Vein House and
Retreat. (1984-
1986) Designed
by Norman
Foster.**

Case Study I: Rebuilding The New Reichstag (1992-1999)

Background:

After World War II, Berlin was a crippled pawn, stuck between the East and West, with a literal and iconic wall deeply dividing the two worlds. After the dismantling of the wall, a rejuvenated Berlin was emerged in a wave of ambitious construction, among which the most symbolic was the New German Parliament, the Reichstag.

The new German Parliament was determined to locate in the building Reichstag, Berlin. An international competition was held in 1992, seeking a refurbishing design for this historic Reichstag building. After the second round, Norman Foster won the project in 1993. Ever since the beginning of the competition, this project has been closely traced and heatedly discussed. The importance of this particular project lies into two aspects. First, it was one of the most exciting projects after the unification of West and East Germany. The entire country, Europe, and the international community were hoping to see a new democratic spirit in the capital and its new building. Secondly, for Norman Foster, the project was a unique task that required not only his knowledge of sustainable technologies, but also an accurate comprehension of Germany's anticipation for this project that reflected their culture, history, and political aspiration.

Design Description:

The first round --- Umbrella theme:

In the first round of the competition, Foster intended to add a large canopy over the existing construction. The vast translucent canopy was supported by twenty fifty-meter-high steel columns, covering the existing and new-built. It would create a new skyline and symbolize the unification of past and present. Under the canopy, he located the chamber for the Bundestag with service space on the main floor, complemented by theatres, cinemas, galleries, bookshops, cafés, nursery schools, and underground parking lots. These design features would enable the Reichstag to act the role of an urban plaza. The covered area were extended into the River Spree, crossing the former border between East and West, thus representing their reconciliation and integration. Moreover, the canopy would be composed of photovoltaic cells that could generate electricity from solar energy, aiming at make the new Reichstag energy self-sufficient. It was composed by. The sunlight through the curved canopy would also diffuse into the interior. The steel columns functioned as reverse chimneys, drawing down cool air and increasing natural ventilation for the chamber.

Fig. 10 The elevation changes of the Reichstag since it was built. The one above is the umbrella theme Foster designed in the first round of competition. The one below is the dome theme.

Second round (Final pursuit) --- Dome theme:

The first scheme had to be dropped due to financial concerns in 1993. But the ideas behind the umbrella theme —ecological technology, natural lighting and ventilation, “transparency” — remained. In the second stage of competition, after a series of transformation, Foster finalized his design with a cupola over the top of the Bundestag chamber, which became not only a significant feature in this project, but also a key component in the integrated energy-saving strategies. At the center of the “glass-shell”, he located a light-reflecting cone, which is used to mirror the sunlight down into the chamber space. An adjustable sunshade inner skin runs on a track, protecting the interior from direct sunlight, and a suspended ramp spirals up to a roof terrace with a panoramic view of central Berlin. In addition, the roof of Reichstag is also renovated into a public leisure space with a café and restaurant. The original building material — sandstone — is kept partially, whilst some graffiti by victorious Soviet soldiers is kept also demonstrative of the historic fabric that came to light as the 1960’s renovation was peeling off.

Design Concept and Analysis:

Norman Foster grasped the significance of the German cultural context of this project, and focused on “four interconnected issues” in his design process:

1. The significance of the Bundestag as one of the world’s great democratic forums;

2. A commitment to making the process of government publicly accessible;
3. An understanding of history as a force that shapes buildings as well life;
4. A passionate adherence to the low-energy, environment-friendly agenda, which he believe is fundamental to the architecture of the future (Foster 12).

It was a proposal that connected the past by acknowledging history, reflected the democratic present, and responded to the future with its environment-friendly agenda. Through these four emphasized issues, Foster synthesized a holistic design from the political, historical and environmental factions. What was subtly different from other green designs was that the energy performance was not as accentuated as usually. This makes a transformation in Foster's design philosophy: from technology-oriented environmental design, he was ready to step into a new phase with more humanistic content being blended into the design.

1. To the Past:

During the last hundred years, Berlin was the center stage for a series of key historical events, notably the heart of the Third Reich and the focal point of the postwar division. In 1990, unification once again drew international attention to this historic city, which also claimed a new ego as the center of political life in Germany. One could even view the Reichstag chronology as the history of

Germany itself. If Berlin was the national political center, then undoubtedly the Reichstag was the heart of this center. It is a symbolization associated with partially national identity of German.

Today, with Berlin once again serving the nation as the seat of national government, its history, and Germany's history, becomes a sensitive issue. The unhappy memory of the two World Wars and the postwar partition lead to strong negative attitudes towards certain buildings and architectural styles that existed in this city. The relationship between the new building to be constructed and the existing one that needed preservation can actually be viewed as an attitude treating history.

The two themes Foster developed for this competition, though only one of them was eventually pursued, both reflected his conception of how to look at the past — by “covering”, as coined by Thomas A. Markus in The Words Between the Spaces. He also commented specifically on Foster's design scheme “as a way of both acknowledging recent history (rather than obliterating it) and at the same time ‘burying’ residual anxieties about the history under a layer of new democratic meaning” (Markus 150). In this manner, Markus continued, Foster used contemporary architecture to comment on the architecture of the past.

2. To the Present:

Based on a retrospective of history, the refurbished Reichstag makes claims to new national values and aspirations. Nevertheless ideology is abstract, and it needs to be interpreted by architects through architectural language and then perceived by the public. Foster defined the character of “democracy” in this case should be linked to “transparency” and “lightness” (Foster 12), which was physically incorporated into the building.

In distinguishing cultural systems, semiotic meanings of architectural formal elements may be different. In his book, Markus makes mention of a radio program by the BBC, which included contributions from “local architects, planners, commentators and residents” (Markus 150). According to their remarks, an inclination in architectural language can be summarized as:

<i>Semiotic meaning</i>	<i>Authoritarian</i>	<i>Democratic</i>
<i>Architectural Language</i>	stone	glass
	planned urban space	“bricolage”
	preservation	new building
		demolition
		“covering”

Nevertheless, Markus stresses the non-universality of such a list. It is “a system of meanings that has emerged in particular circumstances, and was

specific to its spatial, temporal, cultural and historical context: it is certainly not a universal code" (Markus 150). For example, the stone structure of US Supreme Court may be embraced by Americans as a representation the spirit of democracy --- solid, permanent, and deriving from Classical civilizations. On the contrary, stone reminds Germans of authoritarianism, as it recalls the works of Albert Speer, who was Hitler's favorite architect.

Therefore, Foster's conception of the new Reichstag was based on his observations and understanding of "democracy" in the German cultural context. His choice of glass as a building material was thus supported by such thinking. To achieve maximum transparency, Foster also tried to introduce horizontal and vertical interior views between floors wherever possible. By these means, the entire building not only created visual contact between the interior and exterior, but also established a "sharing" and "belonging" atmosphere inside---sharing the same space, belonging to the same family.

Besides visualizing "transparency" and "lightness", by means of organizing an efficient and functional plan, Foster tried to enough people to psychologically perceive the concept of "democracy". After a close observation of the flowing visitor paths in Bonn's former Parliament building, he created a building that is highly accessible to the public. It was described by Foster himself: "(visitors) walk through the main ceremonial entrance of the their national Parliament building together with the politicians, rise to a public plaza on the roof, continue by ramps

to a viewing platform, look down into the main chamber of Parliament below” (Foster 133). Visitors, through their interactive behavior with this building, will recognize that they are a part of the activities occurring; they are not only spectators, but also participants. This “involvement” will also greatly encourage public interest in governmental affairs.

**Fig. 11. US
Supreme Court.**

**Fig. 12 Plans for
Great Hall.
Designed by Albert
Speers for Hitler in
1940.**

3. To The Future:

To sustain on this planet, human beings rely on substantial living materials. Hence energy preservation will be an eternal concern in S.A. design. Germany is one of the most prominent countries advocating for environment protection and sustainable development. Consequently, the ecological agenda of the new Reichstag would be an important demonstration of the German government's positive policy and position in solving environmental problems. This project aimed at establishing a model for others to follow in future. Through Foster's effort; the new Reichstag became a site for change and an exemplar in S.A. design.

The old Reichstag building was way from "energy-saving". Its existing inefficient heating system led to enormous carbon dioxide emissions annually. The lighting system and ventilation relied mainly on electricity, without any attempting in pursuing natural lighting. Although the thick walls and low ratio of window-openings save the building a relatively high thermal capacity, which helped the building to shut out summer hot waves, it took longer to adapt to a higher temperature in winter. According to the technical data mentioned by Foster himself, the energy consumption was an incredible expenditure: "To raise the internal temperature by one degree on a typical mid-winter's day required a burst of energy sufficient to heat ten houses for a year" (Foster 181). Another statistic showed that it used to cost 2.5 million Deutschmarks annually to run the old Reichstag, including air-conditioning, heating, and catering services. This

energy performance was highly unacceptable for an environmentally aware country.

Foster thus proposed a series of integrated ecological strategies to renovate the Reichstag, the most important of which were the focus on increasing natural sources of lighting and ventilation, and the replacement of fossil fuel with clean and renewable energy.

1) Natural lighting and ventilation

The mirrored cone in the cupola brings sunlight down into the chamber. It also has a second function: its cone shape, with the assistance of mechanical fan, becomes an effective ventilation device. In the chamber, warm air travels up to the ceiling and continued traveling into the cone, where the wider lantern opening naturally accelerates the airflow; finally, the wind outside blows the warm air away. Meanwhile, fresh air is drawn in from a duct located at the west side of building and constantly supplies from the bottom of the chamber. Thus a complete circulation keeps the air flowing throughout the entire building without consuming much surplus energy. Also, the old window openings are filled with “intelligent windows” that have two layers: an inner piece designed to be open manually or controlled by the building’s energy-management system; and a fixed outer piece, with ventilation joints for letting outside air come in; the space between these two layers houses a solar shading device.

2) Renewable energy

Foster substituted the coal or mineral oil in the heating and power generators with clean and efficient vegetable oil refined from date palm, rape, or sunflower seeds. When burning, it emitted only 1560 tons of carbon dioxide per year; assuming Reichstag were to utilize natural gas — the cleanest fossil fuel — the carbon dioxide emission per year would still be about 5800 tons, more than three times that of vegetable oil. The emissions were significantly decreased by 94 percent. As well, the sun shield on track inside the cupola function as a collector of solar energy. It is able to move with the sun as its position changes, thus catching as much solar energy as possible. The power generated from the sun shield also provides electricity to the mechanical fans in the mirrored-cone. With passive technology and renewable energy sources, the new Reichstag is no longer an energy-consuming and pollution-emitting giant; rather, it generates energy to maintain functions of the building. Even can it storage surplus energy by using underground energy reservoirs. The surplus energy would be stored in the form of heated water, which would be pumped up into building via pipes as a supplementary source for heating when needed.

New Reichstag is quite successful as an S.A case. It demonstrates Foster's multi-disciplinary considerations, which include the building's unique position in history, its aesthetic and political attitude, the iconic requisition from government, and supportive advanced technologies. It is highly appreciated by

Germans is not only for its radical technology and terrific energy performance, but also because the design respects their history and culture, and reminds them of their dignity as they strive for a better future. In other words, even if the new Reichstag did not have those breakthrough green technologies used at all, it would still be a well-respected piece of work; if the new Reichstag had only those implements and technologies, it would not be something that German would be proud of.

With respect to S.A., therefore, technology should not become the prevailing factor, despite its importance. S.A. aims at convincing the general public of a new way of leading their lives by holistically designing new environments. To achieve this goal, the interaction between S.A. and the public can be conceived as thusly: acceptance, appreciation, and education. The first two criteria require recognition from the public. The final step, education, is closely affected by the first two steps. After all, the ultimate objective of sustainable development is the restoration of a harmonious relationship between human beings and the environment, which must come through education.

Fig. 13 The new Reichstag dome section.

Fig. 14 The sun-shade runs on rails. Its tubular aluminium blades are designed to screen out solar heat.

Fig. 15 View on the ramp.

Case Study II: The New City Hall in London (2000-2002)

Foster's refurbishment of the Reichstag is definitely successful, and won him Pritzker Architecture Award the same year as it opened. Right after the Berlin project, Foster started another important government commission in London --- the new home for the Greater London Authority. However, this project unfortunately did not continue the holistic method shown in the design of the Reichstag.

Background:

The GLA is the local government of London that came into existence in 2000. After 14 years of lacking regional government, the new GLA stands for a fresh beginning for the city in the new millennium. Constitutionally different from the former body, the GLC (Greater London Council), the GLA tried to distinguish itself from the old one by presenting a new image to public: a more powerful, efficient, and modern leadership for London.

The GLA approved the "More London" development in 2000, which aimed at the area between Hay's Galleria to Tower Bridge. This plan redesigned almost the entire waterfront area between the London and Tower Bridges. It developed a site that had been empty for years into a mixed-use district. The main function is the provision of business and office space, with additional cultural features like theatres, hotels and recreational facilities. Through this re-generation program,

the GLA hoped to attract more business interest to this area and further enhance the economic vitality of the entire city. The new City Hall, located on the south bank of the Thames, next to Tower Bridge and opposite to Tower of London on the other side of the river, was the first building to be completed and was occupied in the summer of 2002.

Design Description:

At first glance, the building looks somewhat like an alien spacecraft, with its shape being squeezed in at one side. In a conventional sense, this building has no front or back. Its spherical shape was calculated according to the sunlight pattern throughout the year by computer. Such a form ensures that the building would expose its minimized surface to direct sunlight. The north side, which receives the smallest amount of direct sunlight, implements the unshaded glazing; but on the south façade, every floor-plate is inclined a little to provide shading for each floor below.

The eighteen thousand square meter building has 11 floors (including one floor underground), and houses various functions. It accommodates the Assembly chamber, committee rooms, public faculties, various offices and restaurants. The Assembly chamber faces north, opposite the Tower of London across the river. The famous spiral ramp theme is located on the north side as well, above the chamber, starting from the ground floor and curving up ten floors. The ramp offers visitors a clear, open view of the Thames and neighbouring

environments, as well as a view down into the Assembly room. The top floor, known as “London’s Living Room”, can be used for public exhibitions or parties, and displays the city skyline to its visitors.

A large, sunken outdoor amphitheatre, named Scoop, leads to a public café on the underground level. More than half of the site was given to public space, including two large piazzas equal in size to Leicester Square and Piccadilly Circus. Also, new streetscapes will create dramatic vistas of landmarks such as the Tower of London and HMS Belfast, a former naval warship that is permanently docked as a museum.

Design Concept:

In Foster’s own words, the City Hall was “designed as a model of democracy, accessibility and sustainability” (Foster and Partners on-line). This description is quite similar to his “four interconnected issues” in the new Reichstag design, except for the lack of “history as a force which shapes buildings”.

1. Identical Designs for Democracy and Accessibility

To realise the vision of democracy, accessibility, and sustainability, Foster duplicated the famous spiral ramp theme he created for the new Reichstag under the name “democracy in London”. Having the same symbolic meaning as in new

Reichstag, the ramp provides spectators with views into the Assembly chamber and outside. But because the City Hall had to reserve a large proportion area for offices, the space left for the ramp is much smaller compared to its prototype, the Reichstag's forth-meter-cupola. The spacious dignity unfortunately was lost during Foster's implanting operation.

Another fact that has to be considered is that the parliament chamber in Reichstag was situated vertically right below the center of the copula, which also was center of the ramp, while the chamber in the City Hall is located at the north side of entire building. Not only does the former building encompass the metaphorical meaning of the centrality of the Bundestag in German political life, but it also offers a traditionally symmetrical visualization to all the visitors walking on the ramp. The latter, however, is not as successful in either function.

2. Advanced Ecological Technology

However, all these flaws do not prevent the design from being hailed as "sustainable," since to some professionals' thinking, "sustainability" is primarily about the technology agenda. And indeed, Foster did implement cutting-edge technology throughout building.

a) Exterior Form

The modified sphere shape has twenty-five per cent less external surface, compared to a cube of the same volume. Glass has a relatively low thermal capacity, and its transparency allows sunlight to easily penetrate and heat up the

interior. Keeping the heat out of the building is a serious issue for glass-clad buildings to consider. Thus, in the City Hall design, each individual glass panel was calculated precisely in order to determine shading specifications. The same data out of the same computer model was continuously used to laser-cut each panel. As well, high performance glazing glass and highly insulated spandrel were installed to ensure the maximum prevention of heat loss.

b) Interior Condition & Ventilation

To further reduce the energy consumption in cooling and heating the building, the interior environment is enhanced using energy efficient mechanical systems. In the summer, the temperature control mainly depends on chilled beams in the office ceilings. Cold ground water is circulated throughout these beams and the warmed water is returned through a heat exchanger. Afterwards, this “grey” water flowing out would be stored for use in flushing the toilets or discharged into the Thames. Air enters offices through a pressurized plenum underneath the floors. As well, the vents on the façade are used for natural, smart ventilation; as soon as they are opened, cooling and heating systems are automatically deactivated.

c) Building Management System (BMS)

A well-designed building system requires proper operation and maintenance to obtain the best performance. According to a survey in Architectural Record, only twenty-five per cent of buildings in Britain are

operating properly (Merkel 116). Therefore, in the new City Hall, Building Management System (BMS) was programmed to maintain and control conditions. The BMS attempts to monitor the efficiency of mechanical systems and the usage of energy-saving systems. It can optimize the energy consumption by shifting between passive technologies and electrical mechanics. The technologies exploited in this City Hall are extraordinary. The digital methods used in design and production ensured a high degree of accuracy in delivering final outcomes.

3. Inadequate Historical Connection

What should be especially noted and explored is that Foster neither mentioned, nor executed “history as a force” in his design process. Nonetheless, the reason are complex. Maybe Foster didn’t think the historical element in this project was a crucial in terms of formulating solutions and generating forms. As a result, his design for London City Hall showed little historical connection with its environment. With reference to his consideration in Reichstag case, the “history” concern should involve and answer two kinds of questions. First, on a micro level, what was the specific historical context behind this building? From such context, what symbolic image is the public expecting to see, or is the architect going to express? Second, on a macro level, does the history of this city or this country influence the choice in architectural form? What kind of form they like or dislike? What is the inclination in their evaluation?

Foster did think about these questions when he conceived the design for new Reichstag, which is evidenced from his achievement. He was also sensitive to the cultural differences between Britain and Germany from the beginning of the competition. As he himself said, "it is symptomatic of the differences between Britain and Germany that at Westminster the public queues are to be let in by a side door, whereas in the Reichstag the people enter the building through the same front door as their elected representative" (Foster 16). Especially after the unsuccessful submission of two masterplan competitions for Berlin in 1991⁵, the awareness of the cultural issue made him sensitive to its importance. He thus paid extra attention to historic events and Germany's consequent understanding of democracy, both of which influenced the rebirth of Reichstag. Realizing himself an "outsider" to Germany, he did intensive research, including how the Bundestag worked as an institution, the history linked to the Reichstag, and German's affection towards it (Foster 21-22). In London City Hall, however, he didn't seem to go through a complete process when forming the principles that defined this project.

⁵ The two masterplan competitions were: 1) Masterplan for the Potsdamer Platz-Leipziger Platz. 2) Strategic Masterplan "Berlin Tomorrow", held by the German Architecture Museum and Frankfurter Allgemeine Zeitung. Both were subject to Berlin's rejuvenation plan after the unification of East and West.

4. GLA HISTORY

The predecessor of the GLA was the GLC (Greater London Council), which was created in 1965 and abolished in 1986 by the Conservatives on the grounds of alleged inefficiency. The current GLA was constituted of the directly elected Mayor of London and the separately elected London Assembly. The Mayor plays an executive role, acts as a spokesperson, and represents the city, while the Assembly has a scrutiny role. Between 1986 and 2000, London had no democratic citywide government. Some critics refer to this period as “15 years of de-regulation and weakened democratic institutions”(Edwards, Michael 25). During those years London’s development strategies largely depended on central government and professional committees. It had a negative impact on the city, one of the three top international business centers, and resulted in faltering economic growth that affected the entire U.K. For instance, between 1995 and 2000, London’s share of identifiable public expenditure in England fell from 18.0 per cent to 17.2 per cent.⁶ Therefore, Londoners regarded the institution of the GLA as a progression or enhancement of democracy. They were anticipating that the new-elected Mayor and the Assembly would be able to revive the leadership in London’s local affairs and implement effective strategies to contribute to the economic growth of the city and nation. Their eagerness can be identified by the fact that the new City Hall was voted as the first building to be constructed in whole More London masterplan. Under such circumstances, the City Hall acts as

⁶ From London Mayor’s report *Investing in London: The Case for the Capital*

a symbol signifying the idea of: confidence, unity, efficiency, honesty, and credibility.

Foster's design, however, showed a set of different images to the public. The precisely calculated form makes "the big, shiny, steel-and-glass egg" (Merkel 113) look even "stranger": The modified sphere geometry "curved inward toward the top on one side, stepped out and upward on the other." The building's shape signifies an unsteady character, looking more like an alien landing unit, which is hard to associate with a public service institution. The form does not convince in representing the new government's confident attitude. Rather, the effect of an ostentatious display, signifying self-righteousness or self-importance.

5. Visual Connection With Context

The location of the City Hall is the South Bank of the Thames. On the same side of the Thames, west of the City Hall site, there are several important modernist landmarks, such as Hay's Galleria, the Guy's Hospital, and the Tate Modern. On the opposite side, historical buildings represent city's famous skyline --- the Tower of London, the Tower Bridge and St. Paul's Cathedral. These new and old endows the site, and indeed the city, with "visual richness and vitality" (Rogers 3.5), Richard Rogers comments in his Report to the Mayor of London on Architecture and Urbanism. However, he also criticized "while the mixed is dynamic and individual views beautiful, the existing skyline and roofscape of London is not of exceptional quality overall" (Rogers 3.6) Therefore, Rogers

proposed that to improve the quality of the visual experience from distant and near views, the city must be specifically aware of design quality and locality, and buildings should be “arranged in a harmonious cluster” (Rogers 3.6). Despite the recommendation, on south bank elevation, we can see that the City Hall itself has become a quarantined object aside the other office buildings. Moreover, its strange curved profile is neither harmonious with the Tower Bridge nor with the group of modernist buildings. In terms of shaping a consistent harmonious façade for the view of the south bank of the Thames, the City Hall has apparently failed in its commission.

Additionally, City Hall's location is also affected by the inevitable challenge from the Tower Bridge and Tower of London. Admittedly, London has a unique hybrid appearance in terms of architecture. Because of the Great Fire in 1666 and the two World Wars, during which the city was partially destroyed, building styles are quite diverse. Therefore, the relationship between “new” and “old” architecture becomes a complicated issue to deal with. To be harmonious and consistent with the old buildings doesn't mean that all the new architecture has to be in a classical or traditional style; similarly, the new buildings should not be irrespectively confrontational either. The built-environment, as well as architectural styles, must always keep developing and progressing. This kind of evolution is no suddenly thrusting event. Rather, it is a gradual process where by each new generation bases new styles on old ones with some new elements added in and some eliminated. Even if the forms might be different, the basic

aesthetics rules are the same. Architectural styles between generations should have some consistency in scale, height, material, texture, and ornamentation; however, recognizing consistency in the new London City Hall becomes difficult because its form was generated by computer from an absolutely functional perspective. This origin created a jarring visual effect when one pictures the City Hall, the Tower Bridge and the Tower of London.

Also, it has to be acknowledged that under certain circumstances and within specific contexts, not all architectural styles would be successful. The location of the new City Hall is closely connected to the main historical core that stands for cultural identity of London. A building on this site has to be extra sensitive to the area's strong historical pulse, so as to be harmonious with the entire atmosphere, thus to embrace and to be accepted by the architectural community.

A fundamental difference between the new Reichstag and the London City Hall is the fact that the former belongs to the public, but the latter is owned by developers. From the agora of ancient Greece to the great Victorian town halls, and even the former seat of the GLC, most democratic buildings have been owned by the public. But the City Hall is not public property. It is a commercial office building that simply is rented by the GLA for 20 years term. Therefore, the City Hall design displayed a clear commercial characteristic. Its eye-catching form makes a good advertisement for the other office buildings on the same site. Its computer-generated angles, radical shape attracts attention to the building

from both the professionals and general public, which has increased more the economic value of this development project than its democratic contribution. As a financial product, in other words, it is successful.

With respect to a S.A. evaluation, however, the City Hall unfortunately cannot be considered a great success. Although Foster employed even more advanced technology in this one than he did for new Reichstag, his design concepts failed to fully consider the unique cultural and historical context of London. He duplicated the symbolic elements of democracy from the Reichstag, but the ramp is not well-suited for the City Hall's functional program. He generated an architectural form by pursuing the least energy-consuming surfaces and materials, but it conflicts with the existing buildings nearby. A qualified S.A. requires a balance between technology and culture. In the London City Hall case, technology dominated design process, while its counterpart culture was relegated to a less important position.

Fig. 16 South Bank Elevation

Fig. 17: London South Bank of the Thames Map

Fig. 18 View from Nouth Bank of the Thames to look at the City Hall, the Tower Bridge, and the Tower of London.

Fig. 19 View from the top of the City Hall toward the Tower Bridge.

CHAPTER 6 CONCLUSION

One of the purposes of this thesis is to clarify the concept of S.A., without rigidifying the practice into an ideology. A clarified definition of S.A., which acknowledges the importance of interpretation of particular cultural context, will embrace diverse cultural expressions and thus enhance the formal style of S.A. This thesis starts the discussion from a new viewpoint: the meaning of “environment”, and specifically sustainability as an issue dealing with the conflict between human beings and the environment. It offers us a set of holistic answers to the questions such as: “how can human beings sustain their existence in their environment? Or, how can human civilization continue to progress and develop with limited living materials in a finite space?” S.A. is a design trend that practices an ideology of sustainability and aims to respond to these issues from architectural perspective. If the connotation of environment is clear to the design team, then they can propose synthetic solutions that are based on being responsive to each aspect of this concept. Hence, environment is defined with two components: the cultural and the natural. In the continuing discussion, this thesis explores the relationship between nature and culture, and concludes they cannot be explicitly distinguished from each other. The boundary between these two realms is vague and this pair of concepts is often fused. Indeed, considering the extent of human interventions on this planet, the division between the natural and cultural has become much more ambiguous. Both nature and culture generate an influence on architecture, and vice versa. Throughout a historical

retrospection of several major stages in Western civilization, this thesis maintains that architecture is a physical representation of the attitudes that a culture holds toward nature. Therefore, S.A., as a type of architecture that is sensitive to the environment in a comprehensive manner, should not exclusively respond to either of them, while excluding the other.

In current S.A. practice, architecture shows its respect for the natural environment by implementing technologies mainly related to conserving energy. In this area, professionals have made many achievements: alternative renewable energy resources, recyclable building materials, high efficient mechanical systems and so on. However, most architects have not recognized the importance to cooperate with cultural environment in S.A. design. Kris Voorspools in his article Sustainability of the future; rethinking the fundamentals of energy research addresses the demand for energy services still increases exponentially. Although the current efforts on improving energy efficiency and conversion technologies are outstanding, in a long term view, if the driving forces behind such energy demand growth can not be halted, the day will not be far when the renewable energy reaches the limitation and fails to offer sufficient for human sustaining (599). He also pointed out one of the driving forces is “the rising standard of living of individuals” (600). But a deeper investigation will disclose the reason of this persistent rising standard is the cultural influence – a culture based on the ideology of consumerism or environmentalism. Remarkably, the life style advocated in one society not only generates impact on this group of

people, but also further affects other societies. Therefore, what S.A. aims to cure is not merely the symptoms of the disease of our planet, but the cause of such disease. Sequentially, by looking at two projects of Norman Foster, this thesis demonstrates the severe situation of this culture ignorance in S.A. design: even Foster, one of the most prominent sustainable architects in the profession, cannot prevent the specific cultural concerns from being dominated by technological enthusiasm.

Like language, architecture has the capacity to define new ideas and to convey new meanings. The ultimate objective of S.A. is to restore a harmonious relationship between human beings and nature, based on the success of conveying the idea of sustainability to the public. But if S.A. were only to limit itself to technological innovation, then the public would only be impressed by those devices and human capability, without realizing that our technology obsession and self-righteous attitude are the main reasons for today's environmental crisis. Moreover, the acceptance of this new ideology still faces numerous challenges from other ideologies. With the implementation of cultural expression in architectural form, S.A. would be more easily accepted by the community who shares the same background. As S.A. is evolving in technological direction, architects must be aware of the balance between the technology and the culture, and be extremely self-conscious of expressing both in their designs.

An explanation for starting the discourse from the concept of environment is because this paper provides a new vista in the discussion of S.A. practice. In the term “sustainable architecture”, both the adjective and the noun, comprise the essence of S.A., which suggests: first of all, S.A. is architecture; secondly, its objective is humanity sustainability. Architecture should spontaneously display a duality of technology and aesthetics. Promoting a cultural harmony with existing context is the urgent compensation for S.A.

BIBLIOGRAPHY

Anink, David, Boonstra, Chiel and Mak, John. Handbook of Sustainable Building.

London: James&James, 1996

"City Hall". Foster and Partners. Updated 6 August 2004. Retrieved 6 August

2004 < <http://www.fosterandpartners.com/internetsite/html/>>.

Compact Edition of the Oxford English Dictionary, The. New York: Oxford

University Press, 1971.

Conte, Emilia, and Valeria Monno. "Integrating Expert and Common Knowledge

for Sustainable Housing Management." Towards Sustainable Building. Ed.

Nicola Maiellaro. Boston: Kluwer Academic Publishers, 2001.

Cotgrove, Stephen F. Catastrophe Or Cornucopia: The Environment, Politics,

and The Future. Chichester, New York: John Wiley & Sons, 1982.

----- "A Deeper Shade of Green". Nature. 4 Jan. 1990.

Crowe, Norman. Nature and the Idea of A Man-Made World. Cambridge,

Massachusetts: MIT Press, 1995.

Curl, James Stevens. A Dictionary of Architecture. Oxford, New York: Oxford

University Press, 1999.

Davies, Colin. High Tech Architecture. London: Thames and Hudson, 1988.

Drengson, Alan. "The Deep Ecology Movement". The Trumpeter. 12.3 (1995). 5

Sep. 2004. <<http://trumpeter.athabascau.ca/content/v12.3/drengson2.html>>.

Edwards, Brian, and Chrisna Du Plessis. "Snakes in Utopia: a Brief History of

Sustainability." Architectural Design July, 2001: 9-19

- Edwards, Michael. "Wealth Creation and Poverty Creation: Global-Local Interactions in the Economy of London". City July 2002: 25-42.
- Farmer, John. Green Shift: Changing Attitudes in Architecture to the Natural World. Ed. Kenneth Richardson. Oxford, UK; Boston: Architectural Press, 1999.
- Foster, Norman. Rebuilding the Reichstag. Woodstock, NY: Overlook Press, 1999.
- Foster Catalogue 2001. Munich; New York: Prestel, 2001.
- Glacken, Clarence J. Traces on the Rhodian Shore. London: University of California Press, 1967.
- Hagan, Susannah. Taking Shape: A New Contract Between Architecture and Nature. Boston: Architectural Press, 2001.
- IUCN, UNEP, and WWF. Caring for the Earth: A Strategy for Sustainable Living. Gland, Switzerland: IUCN, UNEP, WWF, 1991.
- Kant, Immanuel. Critique of Teleological Judgement. Trans. James Creed Meredith. Oxford: Clarendon Press, 1952.
- Kaplan, Robert D. The Coming Anarchy: Shattering The Dreams of The Post Cold War. New York: Random House, 2000.
- Markus, Thomas A. The Words Between the Spaces: Buildings and Languages. London: Routledge, 2002.
- Mendler, Sandra. The HOK Guidebook to Sustainable Design. New York: Willey., 2000.

Merkel, Jayne. "Seeking the Shape of Green". Architectural Record Feb. 2003: 110-121.

Palma, Vittoria Di. "Architecture, Environment and Emotion: Quatremère de Quincy and the Concept of Character", AA Files volume 47: 45-56.

Rogers, Richard. "Proof of Evidence of Richard Rogers Chief Adviser to the Mayor of London on Architecture and Urbanism". Retrieved 6 August 2004.
<http://www.london.gov.uk/mayor/planning_decisions/call-ins_appeals/evidence/richard_rogers_summary_proof_of_evidence.pdf>.

Scully, Vincent Joseph. The Earth, The Temple, and The Gods: Greek Sacred Architecture. New Haven: Yale University Press, 1979.

Taylor, Angus. "Inhaling All the Forces of Nature: William Morris's Socialist Biophilia". The Trumpeter. 14.4 (1997). 5 Sep. 2004.
<<http://trumpeter.athabascau.ca/content/v14.4/taylor.html>>.

Van der Veen, E.Wilma. "Environment Movement: A Brief History of Environment History". 14 May, 2002. 1 Jun, 2003.
<http://hosting.uaa.alaska.edu/afewv/environment_movement.htm>.

Wines, James. Green Architecture. Ed. by Philip Jodidia. New York: Taschen, 2000