EXPLORING THE OPPORTUNITIES FOR QUALITATIVE
CONSIDERATIONS OF SUSTAINABILITY IN THE INTERIOR
ENVIRONMENT

By

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To the Faculty of Washington State University:

The members of the Committee appointed to examine the thesis of Naoko Barker find it satisfactory and recommend that it be accepted.

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Chair
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EXPLORING THE OPPORTUNITIES FOR QUALITATIVE CONSIDERATIONS OF SUSTAINABILITY IN THE INTERIOR ENVIRONMENT

Abstract

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The 21st century calls for a sustainable approach to design. It is the role and responsibility of the designer to provide an environment that is enduring for future generations. This requires integration of “state of the art technology” with age-old issues of “good design”. The current national standard for sustainable design is Leadership in Energy and Environmental Design (LEED), a checklist of technical considerations. A building is deemed to be a particular “shade of green” depending on it’s compliance with matters such as energy efficiency and recycled materials. It is observed that this singular approach is deficient in bringing forth a truly sustainable environment. Qualitative issues must be addressed.

This research asks the question from the perspective of an interior designer: What are the qualitative considerations specific to sustainable design in the built environment? The secondary question is how can one simultaneously consider technical and qualitative issues? The goal of the research is to develop a way for understanding qualitative issues that emerge from a holistic sustainable design approach.
The current models of sustainable design are in agreement that aesthetics are vital to a successful sustainable approach. Yet there is no clearly developed framework for designers to understand aesthetic issues specific to sustainable design. This research builds such a framework by adapting George Santayana’s aesthetic theory to the built environment. Design research is methodology for this inquiry. It was an ongoing process in which there were four cycles. Each process consisted data collection, analysis, and ideation evolving around the existing literature to extract the key information. The new knowledge acquired from each cycle was transferred to the next cycle, therefore, the knowledge to answer the inquiry for this research expanded as the process was proceeded.

Conclusions suggest that qualitative considerations of sustainability in the interior environment are symbolic. When qualitative issues and technical issues of sustainability are considered simultaneously as the strategies to achieve symbolic concepts of sustainability, design becomes resonant and holistic.
# Table of Contents

<table>
<thead>
<tr>
<th>Acknowledgements</th>
<th>iii</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>iv</td>
</tr>
<tr>
<td>List of Tables</td>
<td>ix</td>
</tr>
<tr>
<td>List of Figures</td>
<td>x</td>
</tr>
</tbody>
</table>

## Chapter

1. Introduction
   - Background
   - Problem Statement
   - Justification
   - Key Definition
      - Sustainability

2. Literature Review
   - Introduction
   - Existing Frameworks of Sustainable Design in the Built Environment
      - 3-E Model by William McDonough
      - Three Considerations by Mary Guzowski
      - Checklist by Williamson, Radford, and Bennets
      - Leadership in Energy and Environmental Design Guideline (LEED) Green Rating System
   - Summary of Literature Review

3. Methodology
Introduction

Cycle 1: Review of the existing design projects

Data Collection

Analysis

Ideation

Cycle 2: Sustainable design competition- “Design with Memory”

Data Collection

Ideation

Analysis

Cycle 3: Investigation in Leadership in Energy and Environmental Design (LEED) Design Guideline under the aesthetic framework

Data Collection

Analysis

Ideation

Cycle 4: A spiritual space

Data Collection

Ideation

Analysis

4. Findings

Introduction

Cycle 1: Review of the existing design projects

Cycle 2: Sustainable design competition- “Design with Memory”
Cycle 3: Investigation in Leadership in Energy and Environmental Design
(LEED) Design Guideline under the aesthetic framework 59
Cycle 4: A spiritual space 66
Summary 71

5. Conclusion
   Conclusions 72
   Further Studies 75
Bibliography 75
List of Tables

1. Summary of Literature Review.................................................................25
2. The matrix in Cycle 1..............................................................................51
3. The matrix in Cycle 2..............................................................................58
4. The aesthetic opportunities of Energy & Atmosphere..............................61
5. The aesthetic opportunities of Materials & Resources............................62
6. The aesthetic opportunities of Indoor Environmental Quality..................62
7. The matrix in Cycle 4..............................................................................70
List of Figures

1. William McDonough’s 3-E Model..................................................11
2. Williamson, Radford, & Bennetts’ Partial checklist..............................17
3. LEED’s checklist..............................................................................22
4. The four cycles of design research....................................................27
5. Cycle 1............................................................................................28
6. The interior space of the Bank of Astoria...........................................28
7. The interior space of the Bank of Astoria...........................................28
8. The interior space of Adam Joseph Lewis Environmental Center............29
9. The interior space of Adam Joseph Lewis Environmental Center............29
10. The interior space of C.K. Choi Asian Research Center..........................29
11. The interior space of C.K. Choi Asian Research Center..........................29
12. The sketch in Cycle 1.................................................................31
13. The sketch in Cycle 1.................................................................31
14. The sketch in Cycle 1.................................................................31
15. The sketch in Cycle 1.................................................................31
16. Cycle 2..........................................................................................32
17. Aerial site photograph....................................................................33
18. Site information for “Design with Memory”.........................................33
19. The study of the structure of the bridges.............................................34
20. The study of the relationship between the light and wood materials........34
21. A conceptual sketch of a path on the tower........................................35
22. An initial conceptual sketch............................................................35
<table>
<thead>
<tr>
<th>Number</th>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>The photographs of the model</td>
<td>36</td>
</tr>
<tr>
<td>24</td>
<td>The site plan</td>
<td>36</td>
</tr>
<tr>
<td>25</td>
<td>Cycle 3</td>
<td>38</td>
</tr>
<tr>
<td>26</td>
<td>Meditation space for UNESCO</td>
<td>39</td>
</tr>
<tr>
<td>27</td>
<td>Thorncrown chapel</td>
<td>39</td>
</tr>
<tr>
<td>28</td>
<td>Tea house</td>
<td>39</td>
</tr>
<tr>
<td>29</td>
<td>St, Ignatius chapel</td>
<td>39</td>
</tr>
<tr>
<td>30</td>
<td>Cycle 4</td>
<td>41</td>
</tr>
<tr>
<td>31</td>
<td>The study of the Golden Proportion</td>
<td>42</td>
</tr>
<tr>
<td>32</td>
<td>The study of the Golden Proportion</td>
<td>42</td>
</tr>
<tr>
<td>33</td>
<td>The study of floor plans from the various sacred spaces</td>
<td>42</td>
</tr>
<tr>
<td>34</td>
<td>The study of floor plans from the various sacred spaces</td>
<td>42</td>
</tr>
<tr>
<td>35</td>
<td>The site analysis-wind</td>
<td>43</td>
</tr>
<tr>
<td>36</td>
<td>The site analysis-wind</td>
<td>43</td>
</tr>
<tr>
<td>37</td>
<td>The site analysis-sun</td>
<td>43</td>
</tr>
<tr>
<td>38</td>
<td>The site analysis-sun</td>
<td>43</td>
</tr>
<tr>
<td>39</td>
<td>The initial parti</td>
<td>44</td>
</tr>
<tr>
<td>40</td>
<td>The conceptual sketch of the plan</td>
<td>44</td>
</tr>
<tr>
<td>41</td>
<td>The conceptual sketch of the plan</td>
<td>44</td>
</tr>
<tr>
<td>42</td>
<td>The conceptual sketch – relationship between the material and form</td>
<td>44</td>
</tr>
<tr>
<td>43</td>
<td>The conceptual sketch – relationship between the light, air, and path</td>
<td>44</td>
</tr>
<tr>
<td>44</td>
<td>Lines at the Bank of Astoria</td>
<td>49</td>
</tr>
<tr>
<td>45</td>
<td>Lines at the Bank of Astoria</td>
<td>49</td>
</tr>
</tbody>
</table>
46. Form and shape at Adam Joseph Lewis Center

47. Form and shape at Adam Joseph Lewis Center

48. Light at the Bank of Astoria

49. The structure of the tower

50. The haptic experience of the tower

51. The maximum use of natural light and ventilation

52. The use of recycled wood

53. The light box – earth & cosmos

54. The light box – a sense of time

55. The light box – spiritual

56. The interior space of A Spiritual Space

57. The presence of water

58. The second floor plan – A Spiritual Space

59. A section – A Spiritual Space
Dedication

This thesis is dedicated to my husband, Tim, and my children, Tyler and Emma who provided unconditional love and support
Chapter 1. Introduction

Background

The built environment in the 21st Century urgently calls for a consideration and effort of sustainability. It is the role and responsibility of the designer to provide an environment that is enduring for future generations by practicing sustainable design. The current sustainable approach in the built environment focuses on the technical considerations that are based on measurable performance, such as energy efficiency.

According to the study conducted by the Chicago-based firm, Chicago Research, Inc, (Coleman, 2000), there was a noteworthy disconnect between theoretical acceptance and actual application of sustainable design among the professional interior designers. Coleman (2000) claims that the motivations to apply sustainable design for clients centers around economic consideration. Therefore, unless the benefit of having a sustainable design is directly related to the cost and energy efficiency, designers will not be able to offer sustainable design to clients. This notion suggests that sustainable design is understood by quantitative criteria and that the application of sustainable design is subject to economic consideration. Sustainable design, however, is more complex and holistic than compiling energy and cost efficiency.

Designers have the power to make sustainable design a priority (Coleman, 2000, p2). It is their responsibility to inform and educate clients that the concept of sustainability goes beyond considerations of technical issues of sustainable design in the built environment. Sandra Mendler, AIA, Sustainable Design Principle, HOK San Francisco, (2001) states that sustainable design is a much more holistic way of looking at
quality in design. “With a different way of designing and a different and more expanded set of priorities” (p5) more holistic approach of sustainable design are achievable.

In order to expand the narrow perspective of sustainable design, a unified balance between the technical considerations and non-technical considerations of sustainable design in the built environment is urgently needed. By understanding and taking a multi-dimensional sustainable approach, designers will have a greater potential to fill the disparity between the theoretical acceptance and actual application of sustainable design, consequently making sustainable design a standard practice in any applications.

**Problem Statement**

Design is complex. It influences a wide range of matters. Consideration of sustainability also takes multi-dimensional perspectives. However, sustainable design as it is currently understood in the built environment has lost the complexity of either design or sustainability. Rather, it is regarded as a practice that is based on the scientific matters with quantitative facts. In this image sustainability is “a matter of developing technical devices that neutralize or make benefits out of what may temporarily appears to be problems” (Williamson, Radford, and Bennets, 2003, p31). This notion not only neglects the essence of sustainability, but also neglects the essence of design. In their collaborative book, *Understanding Sustainable Architecture*, Williamson, Radford, and Bennets criticize the current implication of sustainability into the design and urge retaining “a place for ‘mind/body/spirit’” (p8). As the reconceptualization of design, Williamson, Radford, and Bennets (2003) address a traditional inquiry, which is the relationship between the science of architecture and the art of architecture, and introduce
the statement that was made by Mark Hartland Thomas. Thomas wrote a paper to the Royal Institute of British Architecture in 1948:

> Science communicates notion of quantities, verifiable by number, and intended to be the same for all men…Art, on the other hand, communicates notions of value, fantasy, never the same for any two recipients, no two responses being alike, although the relative importance of works of art does emerge from the sum total of many differing responses…It is commonplace that architecture partakes of science as well as of art (Williamson, Radford, & Bennets, 2003, p8).

It is the artistic side of design that attracts and inspires people. Value, fantasy, and beauty are what make a design that is sustainable enough to be around and loved for generations, not the technical devices that neutralize the temporal problems. James Wines (2000), a founder of SITE program and a professor of the Architecture program at Pennsylvania State University, states, “…Without art, the whole idea of sustainability fails. People will never want to keep an aesthetically inferior building around, no matter how well stocked it is with cutting-edge thermal glass, photovoltaic cells, and zero-emission carpeting…” (p20).

According to the current approach of sustainable design, the idea of sustainability is failing. Art, the essence of design, is missing. Without this, sustainable design has no potential to become a standard practice to which everybody aspires.
The primary technical framework and national standard for sustainable design in the United States is Leadership in Energy and Environment Design Guideline (LEED) Green Building Rating System. Having a building certified by LEED by fulfilling the required technical criteria has become a common custom in practicing sustainable design. It is observed that this singular approach is deficient in bringing forth a truly sustainable environment as the artistic considerations of sustainable design are absent. This research asks the question from the position of an Interior Designer: What are the qualitative considerations of sustainable design in the built environment? The secondary question of which the research asks: is there a framework to integrate and consider qualitative issues and quantitative issues simultaneously under the existing framework? LEED provides the technical framework sufficiently, however, it is incomplete since the approach is not holistic. A framework that addresses the two distinct perspectives is needed to aim for a holistic sustainable approach.

The primary goal of this research is to investigate the qualitative considerations of sustainable design in the built environment. The secondary goal is to discover a framework that integrates qualitative considerations and technical considerations of sustainable design in the built environment under the existing frameworks.

Justification

There are a number of discourses that emphasize the importance of qualitative issues of sustainable design. American Institute of Architects (AIA) and International Union Architects (IUA) used the term “an aesthetic sensitivity” as an element of sustainable design as well as resource and energy efficiency, materials, and socially
sensitive land use (Guzowski, 1995). Aesthetics also appeared as a part of sustainable design quality to evaluate the design projects for The AIA/COTE Top Ten Green Projects Competition. The program is to identify and recognize built projects that demonstrate the sustainable design approach that “includes performance, aesthetics, community connection, and stewardship of the natural environment” (http://www.aia.org/cote/tepten/.) According to the statement, AIA acknowledges and values “aesthetics” as an important quality of sustainable design and encourages designers to approach sustainability from multiple perspectives.

People aspire to beauty. The essential purpose of design is to fill the earth with places that are beautiful. Christopher Day (2002), a British architect, calls this “a route to ecological harmony” (p26) exclaiming that it is the designers’ commitment to make places beautiful that has an absolute spiritual value. “The philosophy of sustainability is a perception of eternity” (Wines, 2000), which includes not only the eternal resources and energy, but also eternal soul and spirit.

Beauty, which embodies layers of other humanistic values, is indispensable as a fundamental quality of sustainable design in the built environment. The mission of the designers in the 21st Century is to practice sustainable design with a comprehension of aesthetic values specific to sustainability. Knowing the opportunities to transform the aesthetic considerations into the visual language in a space, the quality of design becomes richer with an expanded understanding of sustainability.

Key Definition
It is not intent of this research to seek a definition of sustainability or sustainable design. The research accepts the definition given by the World Commission on Environment and Development report, *Our Common Future*, in 1987:

> Humanity has the ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs…Sustainable development is not a fixed state of harmony, but rather a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs (p8).

This definition is recognized as the global framework of what constitutes sustainability. It contains two important elements. First, it has a concept of time as it foresees future. It acknowledges that sustainable development must be an ongoing process that requires a commitment from all generations for the future, not a temporal solution that requires a conscious and effort of the current generations. Secondly, it encourages the idea of change and discourages the fixed state of mind and concerns. This notion is important, especially in the design discipline since creativity enhances the quality of design.
Chapter 2. Literature Review

Introduction

The review of the literature will discuss four current models of sustainable design. They are the 3-E Model by William McDonough, triadic considerations by Mary Guzowski, a checklist by Williamson, Radford, and Bennets, and Leadership in Energy and Environmental Design (LEED) Green Building Rating System by US Green Building Council. These models reveal different perspectives and emphasis of sustainability in the built environment that are discussed by two different figures and two different groups. McDonough, Guzowski, and Williamson, Radford, and Bennetts, urgently address the importance of qualitative aspects of sustainability in design and criticize the current sustainable approach, which is hegemony of technical concerns. LEED is the most prevailing design guideline in the United States and is recognized as the national design standard.

The review of the literature has two purposes in response to the questions of this research. The first purpose is to find out if any of these existing models and frameworks identify the opportunities for qualitative considerations of sustainability in the interior environment. The second purpose is to investigate whether or not these models and frameworks are successful in considering the qualitative issues and technical issues of sustainability, thereby helping designers to integrate the two different perspectives and attempt a holistic approach.

Five areas of each frame will be reviewed in order to answer the above inquiries. The first area is the philosophy that drove each model. What is the foundational philosophy of the author from which each framework was developed? The second area is the scope of their frameworks. What constitutes their frameworks? The third area that
will be reviewed is the idea of aesthetics in the framework. How does his or her framework address aesthetics? The fourth area is the limitation of each framework. What are the limitations of the frameworks? The fifth area is the examination of holistic approach. Does the framework address or succeed in encouraging a holistic approach in sustainable design?

In the summary of the literature review, a discussion of the overall conclusion will attempt to identify that there is a deficiency or negligence in all of the above frameworks.

3-E Model by William McDonough

William McDonough, an internationally recognized leader in sustainable design, is a principle at McDonough & Partners and the former Dean of the Architecture at University of Virginia. McDonough & Partners, lead by William McDonough has designed a number of projects that, “embody new and enduring standards of economic, ecological, and social responsibility” (McDonough & Partners, 2003). McDonough plays a primary role in sustainable design. He has written a number of articles and books and has lectured extensively promoting his philosophy of sustainability. This philosophy has been adopted and implemented in numerous design projects.

McDonough’s approach is based on the idea of “eco-effectiveness” (McDonough, 2002). McDonough criticizes the current sustainable approach by claiming that efficiency has no independent value when it is considered as the single element of sustainable design. According to McDonough, efficiency becomes valuable when it is conceptualized and utilized as a tool to enhance the overall quality of design. He explains that there is no art in efficiency and says:
In a world dominated by efficiency, each development would serve only narrow and practical purposes. Beauty, fantasy, enjoyment, inspiration, and poetry would fall by the wayside, creating an unappealing world indeed (McDonough, 2002, p65).

McDonough’s 3-E Model suggests ecology, economy, and equity to be the three fundamental keys of sustainable design. It is “a visualization tool that allows us to conceptualize and creatively examine a proposed design’s relationship to a multiplicity of factors” (McDonough and Braungard, 2000, p150-151). The model consists of fractal tiles, “a form with no apparent scale that is composed of self-similar parts” (McDonough and Braungard, 2000, p151). Each sustainable design project resides in a tile position unique to its goal, strengths, and concept. The 3-E Model suggests what considerations a particular project focuses depending on the position of the designated tiles.

In this framework, ecological and environmental considerations including technical issues are subject to the area of ecology. The area of cost addresses the financial inquiry; it not only evaluates the cost efficiency of the project, but also evaluates how the project benefits the financial conditions of the business, people, and community. According to McDonough (2002), equity includes humanistic considerations and social and cultural issues, which inquires “fairness” of each design decision to the people and social and cultural structure.

The visual effect of the 3-E Model is simple and easy to grasp (see figure 1). It is a triangle geometry that embodies multiple triangle tiles inside. As it is intended to be a visualization tool to conceptualize and examine a proposed design’s relationship to a
multiple of factors, the 3-E Model visually demonstrates the balance between the three factors when a design solution or project is evaluated with the interior triangle tiles. Therefore, it is flexible to each design solution and each project, reflecting a complexity of design in general and addressing the multi-dimensionality of sustainability.

McDonough (2002) further mentions a traditional architectural triadic model of aesthetics, function, and cost. He claims that a true sustainable design should aim for the integration of his 3-E Model and this triadic model. What is added here by bringing in the traditional architectural model is a consideration of aesthetics since function and cost are already embodied in the 3-E Model.

It has been observed that McDonough regards aesthetics as an essential element in sustainable design; the term “aesthetics” appears frequently in his previous writings. For instance, in the Hannover Principles, design guidelines established McDonough for the World’s Fair 2000 in Hannover, Germany, McDonough states, “design may encourage a sense of permanence and community… the solution must present an aesthetic statement which sets up human society as a conduit toward the further understanding of nature” (McDonough 1992). However, his 3-E Model does not set up aesthetics in the forefront as a fundamental element of sustainable design. Rather, it is briefly brought out with a compliance with the traditional architectural model that includes aesthetics in its framework.

The limitation of this framework is the exclusion of aesthetics. By integrating the traditional architectural model, the 3-E Model becomes more like 3-E Model plus aesthetics. This raises the question, why does the 3-E Model not include aesthetics in the first place, or is it already embedded in the three areas?
The McDonough’s framework encourages a holistic approach to sustainable design since it does not separate the qualitative issues and technical/quantitative issues, rather, it address the two perspectives concurrently in the three areas of ecology, economy, and equity.

![William McDonough’s 3-E Model](image)

Figure 1: William McDonough’s 3-E Model

**Three Considerations by Mary Guzowski**

Mary Guzowski (1999) is an assistant professor at the architecture department at the University of California, Berkley and author of *Daylighting for Sustainable Design* (1999). She suggests a triadic approach to sustainable design, which interweaves environmental issues, aesthetics of design, and human considerations. There are two reasons as to why a review of Guzowski’s framework is necessary. First, as Guzowski (1999) remarks, daylight is not only the primary focus for technical concerns of sustainable design, but also it is the most compelling subject for aesthetic concerns. It was necessary to review what an authority of daylight states regarding the role of aesthetics in sustainable design. The second reason is due to the fact that Guzowski,
herself, also poses a similar question to the question of this research in her book: “we are well aware of the pragmatic aspects of sustainable design, but what are its poetic and experiential implications?” (Guzowski, 1999, pxxvi). Guzowski’s answer to her own question is briefly summarized as the designs that “respect the land, wildlife, and environmental forces while creating meaningful, healthy, healing, and aesthetically beautiful environments” (Guzowski, 1999, pxxviii). It is necessary to review her framework to examine whether or not it clarifies the opportunities for aesthetic considerations of sustainability in the interior environment.

Guzowski (1999) urges the limitation of sustainable design that took place in the 1960s and 1970s in which experimentation and explorations were focused on passive solar, earth-shelters, and energy efficiency. She claims that these technical issues are only a part of the larger picture of sustainable design. Sustainable design in 1960s and 1970s was limited as it neglected other elements of the large picture, such as aesthetics, beauty, health, well being, and quality of life. Guzowski (1999) claims that without aesthetics and human considerations, sustainable design is incomplete.

Her framework includes three considerations: environmental considerations, architectonic considerations, and human considerations. Although the discussion in this book is primarily about the application of daylighting in sustainable design, Guzowski’s discussion and model are applicable to sustainable design in general. “The framework should be viewed as something that is flexible, adaptable, and capable of change and growth” (Guzowski, 1999, pxxvii). This acknowledges complex layers of issues in sustainable design.
In Guzowski’s model, environmental considerations suggest a relationship between external environmental factors that can be achieved with technical considerations and ecological concerns. According to Guzowski (1999), architectonic considerations are the role of daylight aesthetics in sustainable design. Human considerations suggest the influence of internal environmental factors on human health and well-being and a relationship between the internal environmental factors and social, spiritual connections.

There is no visual presentation for Guzowski’s framework. Visual tools are important to communicate the concept, especially in the design discipline, where everything is communicated in a visual manner.

Guzowski mainly discusses the idea of aesthetics in sustainable design in architectonic considerations. The emphasis is made on form of the buildings and interior environment, such as rooms and windows based on the fact that form affects the aesthetics of daylight in the interior environment. Guzowski (1999) attempts to set criteria that guide to a conscious decision that aims for “qualitative, spatial, and aesthetic effects” (p175). Aesthetic considerations are mentioned as one of the criteria along with other considerations, which are described as “articulation of space, form, structure, and materials, hierarchy and order” (Guzowski, 1999, p175). There are two problematic issues in Guzowski’s aesthetic considerations. First, form is not primary and certainly not the only subject in terms of aesthetics, at least in the design of interior environments. Secondly, the idea of aesthetics is still ambiguous. While Guzowski lists “articulation of space, form, structure, and materials, hierarchy and order” as aesthetic considerations, she
does not address her own inquiry about the poetic and experiential implication of these aesthetic considerations.

There are primarily two limitations in Guzowski’s framework. First, there is no visual tool to present her theory. Secondly, in her framework, aesthetic considerations are concentrated on the geometry of a space.

Guzowski’s framework encourages a holistic approach to sustainable design. As McDonough’s framework does, her framework attempts to integrate the two perspectives together in each consideration. The technical issues and qualitative issues are simultaneously discussed to remind the readers that they influence and enrich each other if design is based on the holistic approach.

Framework (A partial Checklist) of Williamson, Radford, and Bennets

Terry Williamson, Antony Radford, and Helen Bennetts are authors of their collaborative book, *Understanding Sustainable Architecture*. Williamson and Bennetts were educated in architecture in Australia while Radford’s educational background is from the United Kingdom. Currently Williamson is Dean of the School of Architecture, Landscape Architecture, and Urban Design at the University of Adelaide, Australian. Radford is a professor of Architecture at the University of Adelaide, Australia. Bennetts is in the family business after researching sustainable design for a number of years. The review of their book was necessary due to the international background of their education and profession, although this research does not focus on differentiation of paradigm in sustainable design between different countries, societies, and cultures. This research needed to take a look at a framework that was developed in a different country besides in
the United States to see if the approach is any different, or if there is a framework that is
prevailing, thereby can be learned from.

In their book, *Understanding Sustainable Architecture*, Williamson, Radford, and
Bennetts (2003) discuss problems and deficiency in the current existing frameworks and
guidelines of sustainable design. At the same time, they criticize the current sustainable
approach that focuses on quantitative matters and scientific facts that consequently are
the driving factors of those frameworks and design guidelines. According to Williamson,
Radford, and Bennetts (2003), designers must have an ethical way of thinking and ethical
performance, “a beautiful act” in order to achieve true sustainability. Each decision must
be a beautiful act that considers multiple elements and seeks positive resolutions in many
factors. Williamson, Radford, and Bennetts (2003) claim “cohesion” as a necessary
concept in sustainable design since design must be “an integrated entity while
recognizing that it is simultaneously coming from multiple origins and objectives”
(p127). While there are multi-layered dimensions of concerns in sustainable design,
Williamson, Radford, and Bennetts (2003) primarily claim the three contexts of ecology,
society, and building that “constitute the frame within which design takes place” (p130).

The checklist, which they propose as a partial checklist, embodies five categories.
They are environmental impact, social and cultural relevance, occupants, economic
performance, and building longevity. Each discourse issue is to be explored and
evaluated in the five areas during the process of decision-making. The five areas are
stakeholders, objectives, principle active stakeholders, architects’ possible process means,
and aspects of possible product means. While environmental impact, economic
performance, and building longevity categories concern primarily technical issues, social and cultural relevance and occupants address qualitative objectives and considerations.

The visual presentation of their framework is a matrix form of checklist (see figure 2). There are no vertical lines or lines that distinct each discourse issues (five issues of environmental impact, pollution, social and cultural relevance, occupants, economic performance, the building), which suggests openness for any additions and changes. As the title suggests, it appears to be a narrative checklist in which new ideas and changes can be added rather than a fully developed checklist. It communicates their belief that “design is a creative activity, which involves the capacity to visualize new and different ways of doing things” (Williamson, Radford, & Bennetts, 2003, p133). Also, it does not contain a place where actual checkmarks will go; therefore, it suggests that the checklist is rather a tool that helps people conceptualize a coherent approach in their decision-making process.

Williamson, Radford, and Bennetts (2003) do not articulate the idea of aesthetics particularly. Although building is considered to be one of the three contexts of their framework, the focus is on the longevity of the buildings with the considerations of durability, adaptability, and maintainability.

The limitation of the framework of Williamson, Radford, and Bennetts is the fact that three contexts of ecology, society, and buildings, do not come across strongly as their framework in their checklist. Rather, in their checklist, there are five discourse issues in which they place the frame.

The Williamson, Radford, and Bennetts’ framework encourages a holistic approach of sustainable design. Again, qualitative issues and technical issues of
sustainability in the interior environment are intermingled and considered simultaneously in the checklist.

<table>
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<th>Discourse issue</th>
<th>Stakeholders</th>
<th>Objectives</th>
<th>Principal active stakeholders</th>
<th>Architects’ possible process means</th>
<th>Aspects of possible product means</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental impact</td>
<td>Many existing ecosystems, present and future generations of people.</td>
<td>Reduce life cycle greenhouse gas emissions. Create carbon sinks. Mitigate effects of possible climate change.</td>
<td>Designers, clients, occupants, government, builders, product manufacturers.</td>
<td>Life cycle greenhouse gas analysis. Work with client and occupiers on future operation of the building. Work with client in considering the wider system of which the building is a part. Work with builders and product manufacturers on production sources and processes.</td>
<td>Consider: Reducing the need for heating and cooling through building form, materials, and control systems. Using forms of energy in the operation of the building that do not produce greenhouse gases. Using highly energy efficient appliances, water heating and space heating and cooling systems. Using materials and equipment where the use of fuels producing greenhouse gases in their extraction, manufacture and transport is low. Allowing for uncertain future climate. Planting trees.</td>
<td>Credible local data for a life cycle greenhouse gas analysis is hard to find. There are many published strategies for reducing the need for energy using heating and cooling systems: shading, orientation, insulation, Trombe walls, ventilation chimneys, geothermal systems, double skin enclosures, etc. Remember local context, the 'credibility, transferability, dependability and confirmability' criteria, and the need for a life cycle (and not just operating) impact prospective. Future climate change may effect rain, wind, temperatures etc.</td>
</tr>
</tbody>
</table>

Figure 2. Williamson, Radford, & Bennetts’ partial checklist

**Leadership in Energy and Environmental Design (LEED) Green Building Rating System**

Leadership in Energy and Environmental Design (LEED) Green Building rating System has been developed by the U.S. Green Building Councils as a national design standard for what constitutes a green building. The mission statement of the U.S. Green Building Council states, “The U.S. Green Building Council is the nation’s foremost
coalition of leaders from across the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work” (The U.S. Green Building Council, 2003). The committee members of the U.S. Green Building Council who develop LEED consist of city planners, engineers, environmental consultants, builders, architects, and designers. LEED is also a certification tool and checklist for commercial buildings.

The review of LEED was necessary for two reasons. First, it is the most officially recognized framework of sustainable design in the United States, and its application is becoming a common practice of sustainable design. Secondly, the framework is based on “well-founded scientific standards” (The U.S. Green Building Council, 2002, pi). It is purely quantitative and it is a completely different approach from the three frameworks that were reviewed earlier.

LEED aims “to improve occupant well-being, environmental performance and economic returns of buildings using established and innovative practices, standards and technologies” (The U.S. Green Building Council, 2002, pi). The goals of LEED are described as:

- define "green building" by establishing a common standard of measurement
- promote integrated, whole-building design practices
- recognize environmental leadership in the building industry
- stimulate green competition
- raise consumer awareness of green building benefits
- transform the building market
The framework encompasses five categories. They are sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. Each category contains prerequisites and credits of technical criteria that projects must fulfill in order to earn the points to be certified.

LEED articulates the technical framework explicitly by indicating the intent, requirements, the potential technologies and strategies for each criterion. For instance, credit 3.1 in Materials and Resources requires that builders “use salvaged, refurbished or reused materials, products and furnishings for at least 5% of building materials” (The U.S. Green Building Council, 2002, p39). The intent is to, “Reuse building materials and products in order to reduce demand for virgin materials and to reduce waste, thereby reducing impacts associated with the extraction and processing of virgin resources” (The U.S. Green Building Council, 2002, p39). The potential technologies and strategies LEED provides here are to “identify opportunities to incorporate salvaged materials into building design and research potential material suppliers. Consider salvaged materials such as beams and posts, flooring, paneling, doors and frames, cabinetry and furniture and decorative items” (The U.S. Green Building Council, 2002, p39).

LEED also includes an additional area of Innovation & Design Process. The criteria here are implicit, and it is open and up to the applicant to identify what innovative approaches are in each design project. However, it is still limited since LEED suggests design innovations either within its technical framework or as additional technical fulfillments.

One of the most important features of LEED is that it certifies commercial projects that meet a determined number of the requirements. Almost any commercial
projects can apply for LEED certification, and the reasons why they want to be LEED certified are described as,

- Establish recognized leadership in the green building sector
- Validate achievement through third party review process
- Qualify for growing array of state and local government incentives
- Contribute to growing green building knowledge base including use of project information on the USGBC website
- Earn LEED Certification plaque and official certificate

The visual presentation of the framework of LEED is summarized in the checklist. It is simple and easy to understand. It describes the criteria, and yes-or-no answer will go alongside.

The idea of aesthetics is completely omitted in the framework of LEED. It does not intend to address aesthetic considerations of sustainable design because it is from the scientific background perspective.

The limitation of the framework of LEED is the singular approach. It is a well established and respected document that measures and describes technological considerations of sustainable design. However, sustainable design is a multi-dimensional subject that must integrate layers of issues. It is a noteworthy issue that LEED does not include qualitative considerations of sustainable design since it is the most prominent sustainable design guideline in the nation that set up the design standard for sustainable design.
# Project Checklist

## Sustainable Sites

| Y | Prereq 1 | Erosion & Sedimentation Control | 14 Possible Points |
| Y | Credit 1 | Site Selection | Required |
| Y | Credit 2 | Urban Redevelopment | 1 |
| Y | Credit 3 | Brownfield Redevelopment | 1 |
| Y | Credit 4.1 | Alternative Transportation, Public Transportation Access | 1 |
| Y | Credit 4.2 | Alternative Transportation, Bicycle Storage & Changing Rooms | 1 |
| Y | Credit 4.3 | Alternative Transportation, Alternative Fuel Vehicles | 1 |
| Y | Credit 4.4 | Alternative Transportation, Parking Capacity | 1 |
| Y | Credit 5.1 | Reduced Site Disturbance, Protect or Restore Open Space | 1 |
| Y | Credit 5.2 | Reduced Site Disturbance, Development Footprint | 1 |
| Y | Credit 6.1 | Stormwater Management, Rate and Quantity | 1 |
| Y | Credit 6.2 | Stormwater Management, Treatment | 1 |
| Y | Credit 7.1 | Heat Island Effect, Non-Roof | 1 |
| Y | Credit 7.2 | Heat Island Effect, Roof | 1 |
| Y | Credit 8 | Light Pollution Reduction | 1 |

## Water Efficiency

| Y | Credit 1.1 | Water Efficient Landscaping, Reduce by 50% | 5 Possible Points |
| Y | Credit 1.2 | Water Efficient Landscaping, No Potable Use or No Irrigation | 1 |
| Y | Credit 2 | Innovative Wastewater Technologies | 1 |
| Y | Credit 3.1 | Water Use Reduction, 20% Reduction | 1 |
| Y | Credit 3.2 | Water Use Reduction, 30% Reduction | 1 |

## Energy & Atmosphere

| Y | Prereq 1 | Fundamental Building Systems Commissioning | 17 Possible Points |
| Y | Prereq 2 | Minimum Energy Performance | Required |
| Y | Prereq 3 | CFC Reduction in HVAC&R Equipment | Required |
| Y | Credit 1 | Optimize Energy Performance | 1-10 |
| Y | Credit 2.1 | Renewable Energy, 5% | 1 |
| Y | Credit 2.2 | Renewable Energy, 10% | 1 |
| Y | Credit 2.3 | Renewable Energy, 20% | 1 |
| Y | Credit 3 | Additional Commissioning | 1 |
| Y | Credit 4 | Ozone Depletion | 1 |
| Y | Credit 5 | Measurement & Verification | 1 |
| Y | Credit 6 | Green Power | 1 |

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**LEED™ Rating System Version 2.**

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**Figure 3: LEED’s checklist**
Summary

LEED provides a technical framework that is clearly documented and easy to comprehend. Its design guideline has helped people to become knowledgeable and consider technical issues of sustainable design. LEED has helped design firms, such as Skidmore, Owings & Merrill (SOM) by creating “an opportunity to be able to go to the clients and say ‘We can give you quantifiable evidence that your building is a certain shade of green’” (Grahl, 2001, p1). However, this is where LEED has deficiencies. With a framework that addresses only the technical considerations of sustainable design, sustainability becomes a matter of fulfilling scientific quantifiable concerns. Sustainable design has much more significance and meaning than being implicated in the quantifiable evidence.

The framework of LEED is insufficient since it neglects the none-technical aspects of sustainable design. The single bounded approach is not holistic, and it does not reflect the true concept of sustainability.

McDonough’s 3-E model, Guzowski’s model, and Williamson, Radford, and Bennets’ checklist all include qualitative considerations as a key fundamental quality of sustainable design in the built environment. Their frameworks are based on the concept that sustainability is incomplete without intangible factors of beauty, fantasy, spirit, etc. They are based on a criticism toward the current sustainable approach that emphasizes only technical issues. However, the problem is that none of these models provides a comprehensible framework to guide consideration of the qualitative issues of sustainable design. While everybody is in agreement that the aesthetic quality of design is vital,
there is no clearly developed understanding of the opportunities of aesthetics in sustainable design. The qualitative considerations of sustainable design in the built environment remain ambiguous although many individuals emphasize their imperativeness.

This review of the literature concludes by asking the question, what are these qualitative considerations specific to sustainable design? Language, such as beauty and spirit, are repeated over and over by many different people. However, there are no further explanations of what beauty and spirit are in design or how beauty and spirit of sustainability can be transformed into a space. How can a space communicate the idea of beauty and spirit as the concept of sustainability in the interior environment? Is there a way to inspire these ideas more clearly and integrate them with technical issues? This research is based on a hypothesis that a integration of qualitative considerations and technical considerations of sustainability will enrich the quality of sustainable design and encourage a holistic approach.
<table>
<thead>
<tr>
<th>Model</th>
<th>Visual</th>
<th>Scope</th>
<th>Limitation</th>
<th>Holistic?</th>
<th>The idea of Aesthetics</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-E Model by William McDonough</td>
<td><img src="image1.png" alt="Image" /></td>
<td>Ecology, Economy, Equity, +Aesthetics?</td>
<td>It does not include aesthetic although it is mentioned.</td>
<td>Yes</td>
<td>Mentioned, but not clear.</td>
</tr>
<tr>
<td>Three considerations by Mary Guzowski</td>
<td>N/A</td>
<td>Environmental Architectonic Human</td>
<td>No visual. Aesthetic focus is only on form.</td>
<td>Yes</td>
<td>Important, but focused on only form.</td>
</tr>
</tbody>
</table>
Chapter 3. METHODOLOGY

Introduction

The method for this inquiry is the design process. Experts suggest that the design process is comparable to research methods. The design process is a systematic progression of inquiry. It is an ongoing process with one question leading to another (Thompson, 1992). In this study, four cycles of design research processes evolved to support the inquiry. Each cycle consisted of at least three steps: data collection, analysis, and ideation. Data collection involved gathering supportive important information from the existing literature. This information was considered and analyzed in a consistent systematic way to determine relationships. Then, this information was synthesized and tested in design explorations through ideation. Each cycle answered a preliminary question and led to question development in the next cycle resulting in an ongoing movement rather than a series of independent studies. In his book, Inquiry by Design: Tools for Environmental-Behavior Research, John Zeisel (1984) describes this design process as one of the methodologies of design research. According to his model, the design process is a cyclic movement in which there is a process of data collection, analysis, and ideation. With each cycle of the movement the research progresses toward a field of acceptable responses. Zeisel’s model suggests that the process can go on forever.

In this study a pattern similar to Zeisel’s model developed. The four cycles evolved around a large body of information, which was the existing literature. In each cycle, new key information was gathered, analyzed and synthesized in a design
exploration to generate new information. Then, new information was transferred to a new cycle every time, and the body of knowledge kept expanding (see figure 4).

Figure 4: The four cycles of design research evolving around the existing literature review. Each cycle consists of data collection, analysis, and ideation feeding the information to the next cycle.

**Cycle 1: Review of the existing sustainable design projects**

The first cycle began with the question, “what are aesthetics of sustainable design?” In order to explore this question, the study reviewed existing aesthetic theories that could be adopted as a framework. Once an appropriate aesthetic framework was identified, it was adopted for the purpose of reviewing the three existing sustainable design projects through the filter of the framework. The goal was to explore the relationship between formal aesthetics, and sustainability. Then, the question became more specific: how do formal aesthetics communicate the idea of sustainability in a space?
Three award-winning projects from the American Institute of Architects’ (AIA) green building competition were selected for review. AIA acknowledges aesthetics as an important value of sustainable design in the built environment in this competition. The three projects were the Bank of Astoria, Manzanita branch (Manzanita, Oregon), the Adam Joseph Lewis Environmental Center at Oberlin College (Oberlin, Ohio), and the C.K. Choi Asian Research Center at University of British Columbia (Vancouver, British Columbia).

Figure 5: Cycle 1 began with the broad questions. The focus was on formal aesthetics of sustainability.

Three award-winning projects from the American Institute of Architects’ (AIA) green building competition were selected for review. AIA acknowledges aesthetics as an important value of sustainable design in the built environment in this competition. The three projects were the Bank of Astoria, Manzanita branch (Manzanita, Oregon), the Adam Joseph Lewis Environmental Center at Oberlin College (Oberlin, Ohio), and the C.K. Choi Asian Research Center at University of British Columbia (Vancouver, British Columbia).

Figure 6 & 7: The two interior spaces of the Bank of Astoria
Data collection

The research began with a search for an aesthetic theory that could support an aesthetic framework for understanding sustainability in interior environments. Although the theory could be grounded in any discipline, it needed to have the capacity to reflect
the complexity of the nature of design. After having reviewed a number of aesthetic
theories, the most suitable aesthetic theory was that proposed by George Santayana. An
aesthetic framework was developed from Santayana’s theory focusing on three categories
of aesthetics. They are formal, sensory, and symbolic aesthetics. In this cycle, the study
specifically focused on investigating sustainability from the perspective of formal
aesthetics.

In order to consider formal aesthetics specific to the interior environment, the
study adopted a further theory on the five basic design elements by Malnar and Vodvarka
(1992) for this process. They are line, shape, form, texture, and color and light.

The investigation began by abstracting each of the five basic design elements in
two interior spaces per project through sketches and connotations. The task was to create
a sketch of each design element in each space by analyzing graphic images. Each sketch
was to visually articulate and isolate the specific attributes of the subject design element
in a space. This was repeated until thirty sketches were completed.

Data collection also involved the review of the existing literature that discussed
the importance of aesthetics in sustainable design. The purpose was to investigate how
the authorities of sustainable design make a connection between aesthetics and
sustainability in design. The key authorities who were reviewed were James Wines
Analysis

The analysis of the data gathered began by placing each sketch in a matrix. The matrix had a vertical column for the five design elements and a horizontal column for the three projects. Once data was displayed in the matrix, the next tactics was to identify analogies, provide explanations, and evaluate the findings. The purpose was to find out whether or not there are any notable patterns or themes across the five design elements as well as across the three design projects. It was also to define the relationships between the variables and build a logical chain of evidence.

Ideation

Figure12, 13, 14, & 15: The sketches demonstrate the specific characteristics and attributes of different design elements. Clockwise From the above right, texture at the Bank of Astoria, light at C.K. Choi, color at the Bank of Astoria, shape at Adam Joseph Lewis center.
The ideation or brainstorming the first cycle of this design process was an experiment of the idea that developed from the prior analysis. The goal was to explore the findings in the matrix and to visually demonstrate the relationship between the formal aesthetics and the concept of sustainability. The experiment involved design development through modeling and review by faculty and peers. The result was presented in an abstract three dimensional model.

**Cycle 2: Sustainable design competition- “Design with Memory”**

The second cycle in this design process was a design exploration whose theme was “Design with Memory”. The goal was to explore the possibilities of memory as a vehicle to reflect the concept of sustainability in design. The study focused on exploring sensory aesthetics of sustainability through memory. The primary question was, “how do sensory aesthetics communicate the idea of sustainability?” In this process, the sequence went from data gathering and ideation to analysis.

![Diagram](image)

Figure 16: Cycle 2 addresses the next aesthetic category of the framework.

**Data collection**

Data collection involved the review of the existing literature to investigate the relationship between memory, aesthetics, and sustainability. The purpose was to find out
how memory could communicate the concept of sustainability through the aesthetics of design. The key literatures were *Body, Memory, and Architecture* by Bloomer and Moore (1997), an article on the relationship between memory and time written by Bower (2002), and two literatures written by Juhani Pallasmaa (1995 & 1996). It also involved gathering important information for the actual design, such as the site history and historical precedence of old wooden bridges.

Figure 17: Aerial site photograph

Figure 18: Site information
Ideation

The ideation in this cycle was a design exploration of the relationships found in the prior data collection to enter a design competition. It was a hands-on experiment manipulating design elements in response to sustainable challenge through the concept of memory. The goal of this design exploration was to visually demonstrate the relationships found between memory, aesthetics, and sustainability. The exploration involved design development through a series of modeling, drawings, sketches, diagrams, and reviews from the faculty and peers. The result was presented in a site plan, model, and perspective images.

Figure 19: The study of the structure of the bridges

Figure 20: The study of the relationship between the light and wood materials
Figure 21: A conceptual sketch of a path on the tower. Relationship between the horizontality and verticality which is a metaphor for the earth and cosmos.

Figure 22: An initial conceptual sketch. Idea of a tree growing from the leftover concrete structure from the old bridge.
Figure 23: The photographs of the model

Figure 24: The site Plan
Analysis

After completing design, the study conducted an analysis by creating a matrix. The matrix had a vertical column for four key design considerations of site, materials, path, and light and a horizontal column for three aesthetic categories of formal aesthetics, sensory aesthetics, and symbolic aesthetics. It placed a relevant drawing, image, or connotation in each box of the matrix. The purpose was to organize the information in a systemic way to acquire a clear understanding of the relationship between design and aesthetics in response to sustainable challenge through a filter of memory.

Cycle 3: Investigation in Leadership in Energy and Environmental Design (LEED)

Design Guideline under the aesthetic framework

The third cycle in this design process was an investigation of the technical framework of sustainable design literature, Leadership in Energy and Environmental Design (LEED) Design Guideline under the aesthetic framework. The goal was to investigate whether or not the two completely different frameworks (technical and aesthetic) could merge to motivate greater consideration of both aesthetic opportunities and technical opportunities of sustainability. LEED is recognized as the national design standard for sustainable design and as such is the appropriate technical reference.
Data collection

Data collection involved reviewing each technical criteria that was documented in LEED and considering the opportunities for the qualitative issues under the aesthetic framework. In order to make the study specific to the interior environment three primary categories were selected. They were Energy & Atmosphere, Materials & Resources, and Indoor environmental Quality. The goal was to see whether or not technical considerations and qualitative considerations of sustainability actually could be considered simultaneously under the two frameworks. The task was to go over each technical criterion and note their qualitative considerations in the application of three aesthetic categories of formal, sensory, and symbolic aesthetics. This was repeated till the total of forty-five technical criteria of LEED from the three primary categories was reviewed.

Data collection also involved the study of light in existing interior spaces. The study focused on reviewing the light in various spiritual spaces. The question was, “what

Figure 25: Cycle 3 attempted to merge the aesthetic framework and technical framework to motivate considering aesthetic opportunities and technical opportunities simultaneously. Design demonstrated symbolic aesthetics of a technical issue.
“Does this light communicate in a space?” and “What is the relationship between the light and this particular spiritual place?”

![Figure 26: A Meditation Space for UNESCO headquarter office by Tadao Ando. The light coming in from the skylight creates a haptic experience. Integration between the material, form, and light.](image)

![Figure 27: Thorncrown Chapel by Fay Jones. Light can create a rhythm even with the simple minimum interior structure. Relationship between the outside and inside.](image)

![Figure 28: Tea House by Kengo Kuma. Dominance of the shadows. Darkness and shadows with the minimum light can create spirituality. Balance between the horizontality and verticality.](image)

![Figure 29: St. Ignatius Chapei at Seattle University by Steven Holl. Subtle illumines from the vertical slit. Note the integration between light, color, and form.](image)

**Analysis**
The analysis involved organizing the information by placing them in a matrix. The matrix had a vertical column for the technical criteria of LEED and a horizontal column for the three categories of aesthetics. Once data was displayed, the next tactic was to identify patterns or themes across the variables. The purpose was to find out whether or not there are any logical relationships among the technical criteria of LEED under the aesthetic framework as well as between the three categories of aesthetics for each technical category.

**Ideation**

The ideation phase of this cycle in this design process was an exploration of the relationships discovered through the design of light boxes. The goal was to visually demonstrate the possibility of considering both qualitative issues and technical issues of sustainability by merging the two frameworks of LEED and aesthetics. The determination to select light as the technical criteria of LEED for consideration was due to the fact that light had the most opportunities for qualitative considerations. Three key vocabularies from symbolic aesthetics of light were also selected. They were a connection to the cosmos, spirit, and a sense of eternity because those were the words that had kept surfacing as the most essential concepts of sustainability. Each light box was to communicate each word visually with which the light was designed in a light box manipulating the design elements. The exploration involved a design development through modeling and review by faculties and peers.

**Cycle 4: A spiritual space**

The final cycle in this design process was a design exploration of a spiritual space. The goal of this design exploration was to synthesize all the knowledge that was
acquired from the previous cycles in design and visually demonstrate the relationship between aesthetics and sustainability. The reason for creating a spiritual space was due to the fact that the term “spirit” or “soul” was observed as the one of the most consistent words used to describe the essence of sustainability. The sequence of this cycle went from data collection and ideation to analysis.

Figure 30: Cycle 4 experimented all the information gained from the previous three cycles in a design exploration of a spiritual space.

Data Collection

Data collection involved gathering important background information from the literature on sustainable design, spiritual spaces, and historical precedence. The most important texts reviewed in this data gathering process were Sun, Wind, and Light: Architectural Design Strategies by G.Z. Brown (1985), Daylighting for Sustainable Design by Mary Guzowski (1999), Harmony by Design by Rachel Fletcher, and Spirit & Place by Christopher Day (2003).
Figure 31 & 32: The study of the Golden Proportion on the historical precedence

Figure 33 & 34: The study of floor plans from the various sacred places
Ideation

The ideation of this cycle was a design exploration of the relationships between aesthetics, design, and sustainability. The exploration involved design development
through diagrams, modeling, drawings, sketches, and review by faculty and peers. The result was presented in the floor plans, model, and perspective images.

**Figure 39:** The initial parti utilizing the concept of the Golden Proportion

**Figure 40:** The conceptual sketch of the plan modifying the Golden Proportion

**Figure 41:** The conceptual sketch of the plan incorporating the water.

**Figure 42:** The conceptual sketch – the relationship between the material and form.

**Figure 43:** The conceptual sketch – the relationship between the light, air, and path.

**Analysis**

The analysis of this cycle involved organizing information by creating a matrix. The matrix had a vertical column for the two key design considerations, which were path
and place. The horizontal column of the matrix was for the technical considerations from the technical framework of LEED and qualitative considerations from the aesthetic framework. Once data was placed in the matrix, the next tactic was to evaluate the findings. The purpose for this tactic was to find noting patterns across each data and define the relationships between the variables to build a logical chain of evidence.
Chapter 4. Findings

This chapter will discuss the key findings of the study from each of the four cycles of design research. The four cycles evolved around the ongoing review of the existing literature extracting important information. It will also introduce the primary key information from the literature review that influenced each cycle.

Cycle 1: Review of the existing sustainable design projects

The goal of the first cycle for this inquiry was to investigate the relationship between aesthetics and sustainability by reviewing three existing sustainable design projects that received an award from AIA. The investigation began with broad questions: what are aesthetics of sustainable design?

The study began with the review of existing aesthetic theories in order to adopt one theory as an aesthetic framework for this inquiry. A theory did not necessarily have to be from the design disciplines, however, it had to have a capacity to reflect the complexity of interior design. After having reviewed a number of existing theories, the study adopted an aesthetic theory by George Santayana for this inquiry.

In his book, *The Sense of Beauty* (1955), George Santayana, a philosopher, claims, “The philosophy of beauty is a theory of values” (p11). This theory of aesthetics allows that each individual’s different values depending on their individual, cultural, and social background as the assessment system when beauty is regarded or judged. What is more relevant of Santayana’s aesthetic theory specific to the interior environment was his identification of the three categories of aesthetics. Santayana (1955) frames aesthetics into categories of formal, sensory, and symbolic. These three categories are valid for the interior environment. When one experiences a space, multiple factors of these aesthetic
categories come in place as a reference of the beauty of the space. Formal aesthetics in the interior environment can be considered as the visual appearance of a space. Sensory aesthetics in the interior environment are the qualities of a space that impact the multiple senses, and symbolic aesthetics imply communication of meaning from the space to one’s mind. It is true that when one experience a space, these three qualities are essential in a consideration of the space. Therefore, these three categories of aesthetics, which are formal, sensory, and symbolic aesthetics from Santayana’s theory were adopted as an aesthetic framework.

Also the review of the existing sustainable literature found that there were certain vocabularies that were mentioned by a number of authorities. These authorities claim the importance of qualitative consideration in the realm of sustainability. It was found that they regard sustainability in a large picture, and that sustainable design is one of the ways to contribute from the design discipline to a world that is sustainable. In this cycle, the authorities of sustainable design, such as James Wines (2000), William McDonough (2002), Mary Guzowski, Victor Papanek, and Christopher Day were reviewed. The ideas that they mentioned as the essence of sustainability were a sense of eternity, connection to the earth and cosmos, spiritual values, and life. These were claimed as the essential concepts of sustainability. Then, for the purpose of investigating the formal aesthetics of sustainability in the interior environment, the question became, “how can formal aesthetics communicate or demonstrate these vocabularies in a space?”

There are three important findings from this investigation.

The first key finding was the fact that the basic five elements, which represent formal aesthetics, could significantly communicate the concept of sustainability in the
interior environment. The qualities and opportunities of each design element to inspire sustainability in a space are significant. The investigation revealed that the role of the design elements were not only to organize a space, but also to communicate more symbolic meaning. Each design element entails significant qualities and potentials that are associated with the idea of sustainability. For instance, lines at the Bank of Astoria are one of the most essential elements in its space. Lines that appear on the ceiling, in the wood column, and cabinetry express fine craftsmanship of the local craftsmen. The linear qualities of these elements preserve the original beauty of the natural materials. They were treated by those who know how to handle the local materials. They communicate not only a connection and respect to nature but also an honor to the local resources and people. It was observed that form as a design element can ignite sustainability significantly. At Adam Joseph Lewis Environmental Center and C.K. Choi Asian Research Center, the main atria space has an arched ceiling, which captures immediate attention. This vertical emphasis becomes a metaphor for the cosmos. On the other hand, the horizontality of the atria space implies a connection to the earth. For all three projects light was another distinct design element. The abundance of natural light in the interior environments was seen in all spaces. The aesthetic opportunities of light are vast. Light is regarded as one of the most compelling elements in a space for designers to make an aesthetic statement. A number of experts claim that the presence of shadows and shades, is a significant part of the beauty of light. Depending on what types of windows and treatments, qualities of light in a space become different. Also, light is intimately related to a sense of time. Light can indicate the daily sun movement as well as seasonal changes. It was found that the design elements can be viewed as tools to
communicate more symbolic meaning and the opportunity to communicate the idea of sustainability through these elements are immense.

Figure 44 & 45: Lines at the Bank of Astoria. Textures become line in these spaces expressing the fine craftsmanship of local craftsmen. A sense of community has a significant value as a concept of sustainability at the bank.

Figure 46 & 47: Form and shape at Adam Joseph Lewis Center. The balance between the horizontality & verticality, which is a metaphor for the earth & cosmos. The arched ceiling emphasizes the vertical movement, a sense of connection to cosmos. It is a release to the sky.
The second key finding is that certain phrases or ideas emerge throughout the review of the three projects that describe how formal aesthetics communicate the idea of sustainability through the design elements. It was found that formal aesthetics could inspire numerous considerations, such as a connection to cosmos, earth, nature, and time and a concept of honoring the community and people, through the design elements. These vocabularies are mentioned as essential concepts of sustainability by a number of authorities of sustainable design. The study found that these vocabularies were valid for all the interior environments of the three projects that received an award from AIA.
<table>
<thead>
<tr>
<th>Line</th>
<th>The Bank of Astoria</th>
<th>Adam Joseph Lewis Environmental Center</th>
<th>C.K. Choi Asian Research Center</th>
<th>Symbolic Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textures become lines in a space</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td>Craftsmanship Horizontality &amp; verticality (earth &amp; cosmos)</td>
</tr>
<tr>
<td>Horizontal &amp; verticality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td><img src="image4.png" alt="Image" /></td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
<td>A sense of connection to cosmos</td>
</tr>
<tr>
<td>The curved ceiling is dominantly profound in a space. Vertical notion. Connection to cosmos</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Form</td>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
<td><img src="image9.png" alt="Image" /></td>
<td>Earth &amp; cosmos</td>
</tr>
<tr>
<td>The balance between the horizontality &amp; verticality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Texture</td>
<td><img src="image10.png" alt="Image" /></td>
<td><img src="image11.png" alt="Image" /></td>
<td><img src="image12.png" alt="Image" /></td>
<td>Time</td>
</tr>
<tr>
<td>Color</td>
<td><img src="image13.png" alt="Image" /></td>
<td><img src="image14.png" alt="Image" /></td>
<td><img src="image15.png" alt="Image" /></td>
<td>The original beauty</td>
</tr>
<tr>
<td>The original colors of materials. The colors of nature.</td>
<td></td>
<td></td>
<td>Nature</td>
<td></td>
</tr>
<tr>
<td>Light</td>
<td><img src="image16.png" alt="Image" /></td>
<td><img src="image17.png" alt="Image" /></td>
<td><img src="image18.png" alt="Image" /></td>
<td>A sense of connection to cosmos</td>
</tr>
<tr>
<td>The existence of shadows. The movement of the sun. The various types and locations of the windows create different qualities of light in a space. Windows connect people to daily life and outside surroundings.</td>
<td></td>
<td></td>
<td>Time</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Life</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Spiritual</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: The matrix to analyze all the sketches as the data gathered from the review of the award-winning design projects. Note that certain vocabularies kept appearing as the symbolic qualities of the design elements in a space.
The third important finding is that although this particular investigation had an emphasis on formal aesthetics of the aesthetic framework, three categories of aesthetics, formal, sensory and symbolic aesthetics are inseparable in discussions. This notion validates why the opportunities of formal aesthetics to communicate the concept of sustainability are immense and the relationship between formal aesthetics and sustainability is important. It is not formal aesthetics alone that can ignite sustainability in the interior environment. The concept of sustainability comes across stronger and becomes richer because of the interrelated relationship between the three categories of aesthetics. They enhance each other, which makes both a space and a concept of sustainability holistic.

**Cycle 2: Sustainable design competition – “Design with Memory”**

This cycle began with a question: how does memory inform a design to reflect the concept of sustainability? It was also important to discover the aesthetic opportunities of memory in the realm of sustainability. The sustainable design competition in which this design project entered deemed memory as a vehicle to reuse industrial recycled materials in design. Therefore, sustainable design was still regarded from the technical perspective. However, with the concept of memory as a design approach, the mission of this design research became an expansion of the possibility of memory as an inspiration to more poetic and artistic application in design that reflects the value of sustainability.

The design inquiry started with the selection of a site and a design program for the project. After considering a number of possibilities, the decision was to design an observation tower on a site that looks over the Spokane River utilizing the concrete
structure that is left from the old rail bridge. Once this was determined, “Memory of the Old Rail Bridge” became a vehicle of this particular design study.

The challenge was to demonstrate a design that could communicate the concept of sustainability through memory of the old rail bridge. Key information from data collection suggested that memories could be triggered by the human senses. Also, memory has a strong association with the concept of time. Memories will take people to an ongoing mingling of past, present, and future experiences (Bower, 2002). This validated that memory could inform design to inspire the idea of sustainability in a space. Memory can communicate a sense of eternity, which is an essential concept of sustainability. This profound discovery led to the realization of possibilities as to how design could inspire the concept of sustainability by considering memory of the old rail bridge as the vehicle. There are four key findings from this investigation.

The first key finding was that the concept of memory informed the aesthetics of design thereby design demonstrated a poetic application of sustainability. With a filter of the memory of the old rail bridge, the three categories of aesthetics started connecting and intertwining. Each design issue developed a coherence and logical connection to each other. There was a valid rational to design in a certain way based on the concept of memory under the aesthetic framework. The concept of memory established a strong relationship among the three categories of aesthetics and made them intertwined to each other. For instance, the structures of old rail bridges became an inspirational source for the form as in the category of formal aesthetics. This consequently informed sensory and symbolic aesthetics of design. One of the design decisions was a use of recycled wood as the material. This informed not only the color and texture as in formal aesthetics, but
also the sense of hearing, touch, and hapticity as in sensory aesthetics. Symbolically, the observation tower became a reminiscent of the old wooden rail bridge that used to serve the communities and provided a social connection between them.

The design also pursued to create a sense of hapticity through this form. During data collection, the study found that there was a strong relationship between the sense of hapticity and memory. Haptic experiences in a space, particular body responses and movements, are often stored and remembered in the form of memories. A sense of hapticity is significant in the interior environment because it deals with the three-dimensionality of the space. Bloomer and Kent (1997) explain in their book, *Body,*
Memory, and Architecture, that horizontal surface and vertical surface in a space are the metaphor for the earth and cosmos, and through the body, a human in a space “becomes the communication between the two realms” (p59). The haptic experience involves not only the sensory engagement but also symbolic meaning. Vertical movements imply growth, longing, and reaching, and they are bound to “the concept of transition through the cycles of life” (Bloomer & Moore, 1997, p59) while horizontal movements imply absorption, submersion, and compression, and they are bound to “the earthly stage in that cycle – the zone of communication and social interaction” (Bloomer & Moore, 1997, p59). At one time, the old rail bridge used to connect the communities separated by the river. The design decision was made so that the tower would have this sense of connection and continuous social interaction between people and communities.

Figure 50: The haptic experience of the tower is both horizontal and vertical. The path to the observation platform provides horizontal movements as well as vertical movements. The notion implies the relationship between the earth and cosmos.
The second key finding was that the technical agendas of sustainability became rather subordinate in this design exploration. Although fulfilling some of the technical issues of sustainable design was one of the goals as a requirement of the competition, they were rather informed by the aesthetics of design through the concept of memory. They were not the driving factor of design. For instance, the selection of wood as the material was a logical decision based on the concept of memory of the old rail bridge. The natural ventilation system and use of natural light were design decisions for technical considerations. They were informed by the structure of the old rail bridge, which was valid because that was the most energy efficient solution based on the design. The study found that the technical considerations were one of the strategies to approach sustainability in a larger picture.

The third key finding was that the consideration of memory in the aesthetic framework broadened the perspective of sustainability. The experience was with a different set of paradigms to design in response to sustainable challenge. Instead of considering memories as a resource to re-use recycled materials, extending a paradigm beyond fulfilling the technical criteria further helped to realize how memory could communicate the concept of sustainability in an artistic application. With a filter of the aesthetic framework, the study discovered the role of memory in formal, sensory, and symbolic aesthetics. It validated that there were opportunities for qualitative considerations of sustainability in the interior environment with a different way of thinking. Consequently, this realization made the approach multi-dimensional and holistic.
Figure 51: The maximum use of natural light and natural ventilation is the strategy for technical considerations. However, the aesthetic opportunities were more significant for the two issues. The integration with the structure created the intriguing pattern of shadows, connection to the site, and a sense of time.

Figure 52: The use of the recycled wood generates a sense of time through formal aesthetics and sensory aesthetics. The aged beauty, sound, and smell of the old wood ignite a sense of eternity by taking people back to the past time.
Table 3: The matrix to analyze the information acquired from this design exploration in cycle 2. Note that the vocabularies found in the cycle 1 kept appearing, in this cycle, as symbolic aesthetics.
The fourth key finding was that same ideas of sustainability that were found in the first cycle kept appearing in this cycle. The words, such as concept of time and connection to the earth and cosmos were observed as the symbolic meaning of formal aesthetics in the realm of sustainability. It was found that memory also could inspire these essential concepts of sustainability through design when the opportunities for qualitative considerations of memory are considered.

**Design Process 3: Investigation in Leadership in Energy and Environmental Design (LEED) Design Guideline under the aesthetic framework**

The goal of this cycle was to demonstrate a way to consider qualitative and technical issues of sustainability in the interior environment simultaneously under the two existing frameworks. The study selected LEED as the technical framework, and it focused on the appropriate LEED credits. Each credit was to be analyzed under the three categories of the aesthetic framework for their qualitative considerations. There are primarily five key findings from this cycle.

The first key finding was that qualitative considerations and technical considerations of sustainability are side by side. By considering technical criteria with a filter of three categories of the aesthetic framework, the study found that technology and aesthetics are inseparable. For instance, one of the criteria under Materials & Resources is a reuse of building: it requires maintaining existing building shell, structure, and interior parts (U.S. Green Council, 2002). Considering this technical consideration from the aesthetic perspective, reusing a building will preserve the aged beauty, thereby communicate a sense of eternity. This finding significantly widened the perspective of
sustainable design and encouraged a different approach to sustainability in the interior environment.

The second key finding was that it developed patterns of certain words for each primary technical consideration. This was specifically applicable for the words for symbolic aesthetics. For Energy & Atmosphere, LEED primarily requires a building to generate and use on-site reusable energy. The ideas appeared as the opportunities for symbolic aesthetics for this technical issue were, for instance, ecological possibilities and a sense of connection to cosmos. The concept was to exploit and rely on the capacity of the nature rather than generating the energy with the manpower. Also, the use of solar energy is suggested as the on-site reusable energy, which promotes a sense of connection to the cosmos for its eternal existence. For the technical issues of Materials & Resources, the idea that was described as symbolic aesthetics was a sense of eternity because of the infinite reuse of materials. The words, such as quality of people’s lives, well-being, and health, spirit, and a sense of eternity were constantly appearing as symbolic aesthetics for the issues of Indoor Environmental Quality. The core fundamental here is to provide interior environments that are pleasant to the occupants, therefore, enhance the health and quality of their lives.

The third key finding was that the intention of design was to communicate the ideas visually and intuitively, not with words or numbers. During the review, it was found that the light boxes demonstrated how light could inspire the ideas of sustainability better than with the words in the matrix. This was an important observation because it validates that technical reports and checklists, such as in LEED, with the numbers and data are not as compelling as actually seeing the design and being in a space.
<table>
<thead>
<tr>
<th>Technical Framework: LEED</th>
<th>Aesthetic Framework: George Santayana’s aesthetic theory</th>
<th>What are the aesthetic opportunities of the technical criteria of LEED?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy &amp; Atmosphere</strong></td>
<td>Formal aesthetics</td>
<td>Sensory aesthetics</td>
</tr>
<tr>
<td>Prerequisite 1. Fundamental building systems commissioning</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Prerequisite 2. Minimum energy performance</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Prerequisite 3. CFC reduction in HVAC&amp;R equipment</td>
<td>N/A</td>
<td>Thermal comfort&lt;br&gt;Smell&lt;br&gt;Hearing</td>
</tr>
<tr>
<td>Credit 1. Optimize energy performance</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Credit 2. Renewable energy</td>
<td>N/A</td>
<td>Thermal comfort</td>
</tr>
<tr>
<td>Credit 3. Additional commissioning</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Credit 4. Ozone Protection</td>
<td>Minimalism</td>
<td>Thermal comfort&lt;br&gt;Hearing&lt;br&gt;Smell</td>
</tr>
<tr>
<td>Credit 5. Measurement and verification</td>
<td>Light</td>
<td>Thermal comfort&lt;br&gt;Hearing</td>
</tr>
<tr>
<td>Credit 6. Green Power</td>
<td>Form&lt;br&gt;Light &amp; color</td>
<td>Thermal comfort</td>
</tr>
</tbody>
</table>

Table 4: The aesthetic opportunities of Energy & Atmosphere from the technical criteria of LEED under the aesthetic framework. Note the pattern of vocabularies in sensory aesthetics and symbolic aesthetics.
<table>
<thead>
<tr>
<th>Technical Framework: LEED</th>
<th>Aesthetic Framework: George Santayana’s aesthetic theory</th>
<th>What are the aesthetic opportunities of the technical criteria of LEED?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials &amp; Resources</td>
<td>Form aesthetics</td>
<td>Sensory aesthetics</td>
</tr>
<tr>
<td>Prerequisite 1. Storage &amp; Collection of Recyclables</td>
<td>Minimalism</td>
<td>N/A</td>
</tr>
<tr>
<td>Credit 1. Building reuse</td>
<td>Aged beauty (line, color, texture, &amp; light)</td>
<td>Memory (hearing, smell, &amp; texture)</td>
</tr>
<tr>
<td>Credit 2. Construction Waste management</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Credit 3. Resource reuse</td>
<td>Color Texture Form</td>
<td>Memory (hearing, smell, &amp; texture)</td>
</tr>
<tr>
<td>Credit 4. Recycled content</td>
<td>Color Texture Form</td>
<td>Memory (hearing, smell, &amp; texture)</td>
</tr>
<tr>
<td>Credit 5. Regional materials</td>
<td>Color Texture Form</td>
<td>Memory (hearing, smell, &amp; texture)</td>
</tr>
<tr>
<td>Credit 6. Rapidly renewable materials</td>
<td>Color Texture Form</td>
<td>Texture Smell Hearing</td>
</tr>
<tr>
<td>Credit 7. Certified wood</td>
<td>Line Form Color Texture</td>
<td>Texture Smell Hearing</td>
</tr>
</tbody>
</table>

Table 5: The aesthetic opportunities of Materials & Resources from the technical criteria of LEED under the aesthetic framework. Note the pattern of certain vocabularies in the symbolic aesthetics.
<table>
<thead>
<tr>
<th>Technical Framework: LEED</th>
<th>Aesthetic Framework: George Santayana’s aesthetic theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are the aesthetic opportunities of the technical criteria of LEED?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indoor Environmental Quality</th>
<th>Formal aesthetics</th>
<th>Sensory aesthetics</th>
<th>Symbolic aesthetics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite 1. minimum IAQ performance</td>
<td>N/A</td>
<td>Thermal comfort</td>
<td>Well-being &amp; health</td>
</tr>
<tr>
<td>Prerequisite 2. Environmental tobacco smoke control</td>
<td>No tobacco stains</td>
<td>Smell</td>
<td>Well-being &amp; health</td>
</tr>
<tr>
<td>Credit 1. Carbon dioxide monitoring</td>
<td>N/A</td>
<td>Smell</td>
<td>Well-being &amp; health</td>
</tr>
<tr>
<td>Credit 2. Ventilation effectiveness</td>
<td>N/A</td>
<td>Smell</td>
<td>Well-being &amp; health</td>
</tr>
<tr>
<td>Credit 3. Construction IAQ management plan</td>
<td>N/A</td>
<td>Smell</td>
<td>Well-being &amp; health</td>
</tr>
<tr>
<td>Credit 4. Low-Emitting materials</td>
<td>Form, Texture, Color</td>
<td>Smell</td>
<td>Well-being &amp; health</td>
</tr>
<tr>
<td>Credit 5. Indoor chemical &amp; pollutant source control</td>
<td>Tolerance to the damages</td>
<td>Smell</td>
<td>Well-being &amp; health</td>
</tr>
<tr>
<td>Credit 6. Controllability of systems</td>
<td>Light (window, shadows, etc), Outside/Inside (line, form, color, texture)</td>
<td>Smell</td>
<td>Well-being &amp; health</td>
</tr>
<tr>
<td>Credit 8. Daylight and views</td>
<td>Light (window, shadows, etc), Outside/Inside (line, form, color, texture)</td>
<td>Smell</td>
<td>Well-being &amp; health</td>
</tr>
</tbody>
</table>

Table 6: The aesthetic opportunities of Indoor Environmental Quality from the technical criteria of LEED. Note the pattern of the certain vocabularies in the symbolic aesthetics. Symbolic aesthetics of Daylight and Views were demonstrated in a design exploration through the study of light boxes.
The fourth key finding was that formal and sensory aesthetics as well as technical considerations were strategies or ways to achieve the concepts of sustainability that were described in symbolic aesthetics. During the design exploration of the light boxes, in order to communicate three symbolic words of light, the strategy was to manipulate various design elements as well as sensory elements to demonstrate the ideas.

Figure 53: The light box demonstrates the concept of the earth & cosmos. The color and form play the key roles to enhance the quality of light.
Figure 54: The light box demonstrates a sense of time. Line and texture play the key roles to enhance the quality of light.

Figure 55: The light box demonstrates a sense of spirit. Hapticity (verticality & horizontality) plays a key role to enhance the quality of light.
The fifth key finding was a strong realization of symbolism of light in a space, which was the possible reason why designers regard light as the design element that has the most aesthetic opportunities. Light is neither just an ornament nor energy source in a space. It can inspire important ideas that are associated with sustainability. The investigation made it evident that the aesthetic opportunities as well as technical opportunities of light were immense. However, when considerations from the two different perspectives were merged, the idea of sustainability through light became richer and more holistic. Light can communicate a sense of eternity, and it can enhance and enrich the quality of people’s lives. These symbolic qualities make light tremendously compelling.

**Cycle 4: A spiritual Space**

The goal of this cycle, which was a design exploration of a spiritual space, was to synthesize and experiment all the information acquired from the previous three cycles. It was to demonstrate the relationship of aesthetics and technology in the realm of sustainability in the interior environment in the design process as well as in the final product. From the ongoing review of literature, it was found that a number of authorities claim a notion of spirit as an essence of sustainability. This was an opportunity to integrate qualitative considerations and technical considerations of sustainability with a filter of concept of spirit in design. There were five key findings from this study.

The first key finding was that by considering each design issue from the two perspectives, the opportunities to achieve sustainability became significantly vast. It started making a logical sense to design in a certain way, thereby there were rational relationships between every design decision. The three categories of aesthetics and
technical framework started intertwining. For instance, one of the design decisions was to bring a thermal mass as a strategy for the energy efficiency. The aesthetic opportunities of thermal mass under the aesthetic framework were form, light, a sense of hearing, and hapticity. In order to make a spiritual space, the decision was to create a dark circular space with a subtle illumination that reflected the interior of the earth and a sense of time. Each consideration informed another, which made a strong connection between each design decision at the end.

Figure 56: The interior space in which a thermal mass was incorporated as a technical strategy. Spirituality was demonstrated through hapticity (submersion, mineral, etc to imply the interior of the earth) & light (subtle illumination in dark)

Figure 57: The presence of water in a thermal mass interior. It serves a technical purpose as well as aesthetic purpose of sustainability. During the winter, the water will be heated by the solar energy and create a microclimate in a space, which becomes a space for a refuge.
The second key finding was a validation that a sense of spirit was an essential concept of sustainability in a large picture because the concept of spirit was able to

Figure 58: The second floor plan. It was driven by the concept of Golden Section. Interweaving paths create a sense of continuity. The building is oriented with a consideration of wind and sun.

Figure 59: A section drawing. It emphasizes the haptic experience in a space. The paths, place, and water have a balance between the horizontal movements and vertical movements, which implies the relationship between the earth and cosmos.

The second key finding was a validation that a sense of spirit was an essential concept of sustainability in a large picture because the concept of spirit was able to
broaden the opportunities to achieve sustainability in this design exploration. The design concept for this project was how to sustain spirits in this space. Therefore, technical challenges and aesthetic challenges were integrated as the strategies to inspire the concept of spirit in a space. The third key finding was that the true sustainability could not be achieved from a single direction. It requires a multi-dimensional holistic approach. In this design exploration, technical challenges and aesthetic challenges were strategies to accomplish sustainability. During the analysis of the information, it became evident that technical considerations and aesthetic considerations started merging and integrating, therefore, each piece of information no longer was able to be placed in each individual box of the matrix. Each piece, which was the design, was a result of decisions from the multiple perspectives. The distinctions between the technical framework and the three categories of the aesthetic framework began dissipating, and they started merging. This notion validated that a holistic design approach in response to sustainable challenge is possible when each design issue is considered for the qualitative opportunities as well as the technical opportunities.
## Technical Considerations from the framework of LEED

<table>
<thead>
<tr>
<th>Path</th>
<th>Site</th>
<th>Water Efficiency</th>
<th>Energy &amp; Atmosphere</th>
<th>Indoor Environmental Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Orientation (Southern exposure)</td>
<td>- Retaining ponds</td>
<td>- The minimum use of electrical source of energy for heating &amp; cooling (summer path &amp; winter path)</td>
<td>- light &amp; ventilation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Place</th>
<th>Site</th>
<th>Water Efficiency</th>
<th>Energy &amp; Atmosphere</th>
<th>Indoor Environmental Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Orientation (wind buffer)</td>
<td>- Indoor pool</td>
<td>- Thermal mass</td>
<td>- light &amp; ventilation</td>
</tr>
</tbody>
</table>

## Formal Aesthetics

- Spiritual
- Connection to the earth & cosmos
- Life & Death
- A sense of continuity & eternity
- Diversity

## Sensory Aesthetics

## Symbolic Aesthetics – The Concept of Sustainability

Table 7: Intertwining relationships between the variables
Summary

There were a total of four cycles for this research inquiry. It was an ongoing design research in which each cycle informed and led to another. The information that was acquired from the previous cycle was transferred to the next cycle to accumulate and expand the knowledge for this inquiry. Therefore, some of the findings were duplicated which kept appearing in all cycles. The validation of these findings became stronger every time they appeared in the next cycle. In the next chapter, it will discuss the overall conclusions of this design research.
Chapter 5. Conclusions

Conclusions

This thesis began its journey with a broad question, “what are aesthetics of sustainable design?” The inquiry was based on the criticism toward the current attitude and paradigm of the design discipline toward the practice sustainability. Sustainable design is regarded as a matter of fulfilling the technical concerns, therefore the emphasis in on the quantifiable scientific considerations with measurable facts and data. It was apparent that this attitude was not as convincing as it needed to be. Designers are having a difficulty for selling sustainable design to clients in their practice although they know it is an ethical thing to do. Design students lose their interest in studying this subject because they consider sustainable design is boring although they know that it is important to learn about it. The reason for this noteworthy disparity between the theoretical acceptance and actual application of sustainable design either in a professional or educational setting was evident. The singular approach to sustainability that is seen as a norm in current practice and education is missing something that is vital for people who practice, teach, and study design. Inspiration is missing.

The concept of sustainability is beautiful. It is for the all lives on the planet, and it is also for a number of future generations to come. Without a reflection of this concept of beauty, sustainable design has no true meaning. It was essential for the researcher to discover the beauty of sustainable design as the fundamental inquiry in this thesis.

Design research was the methodology for this inquiry. It was an ongoing process in which there were four cycles evolving around the existing literature. In each cycle, the key information was extracted from the review of the literature, analyzed, and
experimented in the design explorations. Then, the new knowledge gained from each cycle was transferred to the next cycle so that there was an overall coherent relationship between the four cycles. This was a great opportunity to investigate the inquiry of this research. It acquired a new knowledge not only from the theoretical investigations as seen in data collection and analysis, but also from the actual applications as seen in ideation of design explorations. The knowledge gained from this design research is more relevant to the inquiry, which is the beauty of sustainable design.

During the study, immediately it became apparent that aesthetic of sustainability in the interior environment is symbolic. It is never a single factor or the visual appearance of a space that expresses the beauty of sustainability. The aesthetics of sustainable design reflect the fundamental concepts of sustainability. They communicate the ideas of eternity, connection to the earth and cosmos, and a sense of spirit in a space. When these symbolic values are present in a space, the design begins to have a life and inspire people. Therefore, technical considerations and aesthetic considerations of sustainable design are only strategies to achieve this symbolism of sustainability. The approach is holistic since it regards sustainability in a larger picture. In this way, people are able to see multi-dimensionality of sustainability because the goal is majestic.

The study also helped the researcher realize that technical considerations and aesthetic considerations of sustainability are intertwined. Every design issue has opportunities for considerations from the both perspectives. The opportunities become immense when technicality and beauty are considered simultaneously. The design becomes resonant and convincing when considerations from the two perspectives are
integrated and intertwined. This approach certainly reflects the complexity of not only sustainability but also design, which makes sustainable design more profound.

The fact that aesthetics of sustainable design is symbolic has a greater potential for the designers, students, and educators to more fully engage with the subject. Designers will be able to sell sustainable design with more passions, and students will be eager to learn it because it is a challenge for technology as well as the heart of design, which is the art. Design educators will emphasize an equal balance between the two perspectives, which encourage a holistic approach to sustainability. With this different paradigm of sustainable design, it is possible to fill the current disparity between the theoretical acceptance and actual application of sustainable design.

Sustainable design is a responsibility and contribution of the design discipline to a world that is enduring. It becomes more meaningful if the discipline demonstrates their competency and commitment to design when practicing sustainable design. The essence of design, which is to create the built environment that is beautiful, cannot be forgotten although sustainable design requires a great knowledge and effort in a technological and scientific development. The environments that express aesthetic sensitivity of the designers will be loved, therefore, will be sustained for a long time in future.

It is the researcher’s hope that this study becomes a departure for a different paradigm of sustainability in the interior environment. Since sustainable development is an ongoing process that requires flexibility and constant changes, this is not a definite solution or tactic to practice sustainable design. However, it is an approach to the design that promotes the enduring interior environment.

Further Studies
The study could be taken to the next step utilizing the same methodology. It will become as the next cycle in this design research process. The next cycle can be in an application of an actual sustainable design project. Will this approach to sustainability in the interior environment, the integration of the technical framework and aesthetic framework, help enriching the quality of design in an actual design project? In any design projects, there are a number of individuals involved who have different backgrounds, expertise, and approaches. However, will this way of considering sustainable issues help guiding a team of many individuals to coherent goals and holistic approach to sustainability? Will this help individuals who have little knowledge and experience in sustainable design to inspire the opportunities for qualitative considerations of sustainability?

The other opportunity is to develop a design guideline for qualitative considerations of sustainability in the built environment that can be used with a conjunction with LEED. Leadership in Energy and Environmental Design Guideline (LEED) Green Rating System provides well-documented information on technical considerations of sustainable design. However, it is insufficient since it omits the qualitative issues. This design guideline for qualitative considerations might be more visual oriented rather than just with the words and phrases since visual presentations seem to communicate aesthetics more explicitly. It also might be more modified version of common design guidelines, which allows flexibility and changes as sustainable development progresses. It will be a design guideline to promote designs that value and reflect broad fundamental concepts of sustainability in the interior environment.
Bibliography


