COLLOSPHAERA: A SITE SPECIFIC INSTALLATION INFLUENCED BY THE THEORIES OF
BIOPHILIA AND BIOPHILIC DESIGN

by

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Approved:

Thom Houser, Major Professor

Date
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Under the Direction of Thom Houser

ABSTRACT

This thesis explores the ideas and theories behind biophilia and biophilic design and their application in a site specific installation within the built environment.

In an endeavor to meld biophilia, a theory originally introduced by Edward O. Wilson, with the design of the built environment, Stephen R. Kellert coined the phrase biophilic design. Biophilic design is the practice of addressing the instinctive human connection to the natural world within manmade surroundings (Kellert, Heerwagen, & Mador, 2008, p. vii, 3). This intrinsic desire for human beings to maintain a constant connection to nature, when effectively addressed within these synthetic spaces, can positively alter the user’s mood, level of efficiency, and general enjoyment of built surroundings. Architects and interior designers have the opportunity, permanently or temporarily, to alter a given space in order to nourish this human need. Site specific installations provide an avenue to adopt these principles, by transforming pre-existing locations effectively and evoking positive responses from inhabitants.

INDEX WORDS: biophilia, biophilic design, installation
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CHAPTER ONE

INTRODUCTION

Nature is a part of our everyday lives. Direct and indirect contact with nature is desirable and ultimately unavoidable. We rise and fall with the sun, breathe in countless breaths of air provided to us by our atmosphere and experience innumerable other natural processes on a daily basis. Nature can serve as a source of inspiration and a source of healing. It helps to guide our days and provides us with a lifetime of memorable interactions.

On the other hand, we cannot deny that a majority of our time is spent within various man-made environments. These environments have the potential to affect, negatively or positively, the way we view or experience nature while we are under their protection. It is this flow of natural and synthetic experiences that has the potential to steer our emotions, our thoughts, and our actions.

PURPOSE OF STUDY

The purpose of this study is to learn and adopt principles behind the practices of biophilia and biophilic design and define their relevance in application within a site specific installation. The proposed installation will be featured in a gallery adjacent to a high trafficked corridor in the Lamar Dodd School of Art during the Master of Fine Arts 2012 Thesis Exhibition. Various faculty, students, and professionals come into contact with this space on a regular basis. The potential to transform this man-made environment and create a pause in
peoples’ daily routine, allowing them to lose themselves for a moment in this new environment, is a main objective in this study.

Injecting nature into a location constructed of glass and concrete through the implementation of various forms in space provides important visual cues, which enable an individual to successfully comprehend and interact with the new environment. The variation and progression of forms in space, in conjunction with consideration of layering and light transference, pattern and color, contribute to enhancing the user’s overall experience within the space while filling the innate human desire for interaction with nature in the built environment.

Collosphaera is inspired by the structure of coral polyps and recognition of the larger environment in which these forms exist. I aspire to transform the built environment and define space with these architectural skins, inspired by nature, in an effort to transport viewers from their typical living and working environments into a setting that encourages interaction and exploration. In addition, Collosphaera is intended to begin to bridge the gap between “art” and “design” within my practice, combining principles and techniques from interior design, fabric design, and printmaking.

I desire to create interior experiences that transcend concentrations and prove easily relatable to a diverse population. I am interested in exploring the avenue of temporary installations in order to determine what types of reactions I am able to elicit from the users of a predetermined space. By interpreting these verbal and non-verbal reactions, I will be able to effectively adapt these new concepts into both present and future design practices.
EXPECTED RESULTS

The common thread may in fact not be an overlapping principle or element shared by art and design, but a common subject of interest: nature. My current work reflects a desire to mimic and employ, within interior spaces, more fluid and organic forms and occurrences found in nature and supported by the theories and guiding principles of biophilia and biophilic design. Studies have proven that even an abstract encounter with natural forms within the built environment has the potential to inspire and even provide healing for the users of that space. This mimicking of natural forms and processes, in theory, should serve to create an environment that feeds the instinctive human desire to remain in close contact with nature while encouraging human interaction and inquisitiveness.
CHAPTER TWO

BIOPHILIA

Bio- originates from the Greek word for life, whereas, -philia stems from the Greek word for an abnormal liking for something in specific ("Bio-," n.d.; "Philia," n.d.). Biophilia may literally be defined as the love of life, a love for natural processes and organisms. Edward O. Wilson, affectionately referred to as Lord of the Ants (NOVA, 2008), coined the name of a human predisposition called biophilia. Stephen R. Kellert (1997) elaborates, “The notion of biophilia emphasizes that healthy and diverse natural systems represent less a luxury than the potential for helping us realize lives of satisfaction and meaning” (p. 4). Biophilia manifests itself in a multitude of ways. There is not one particular trend to track, as biophilic tendencies vary greatly among different cultures and from individual to individual. Our world contains approximately 10 million species. Human beings come into contact with only a fraction of this estimated number. However, whether explored or unexplored, it is undeniable that we have developed a shared environment with fascinating species that are able to continuously adapt and advance in an ever changing world (Kellert, 1997, p. 4-5).

HISTORY

It is this love of life that facilitates the human initiative to aid in the sustaining of nature, as is evident in endless efforts by various individuals and organizations to protect living organisms and species (Wilson, 1984, 1). When Wilson (1984) first explored this idea of biophilia, he noted:

The evidence for this proposition is not strong in a formal scientific sense: the subject has not been studied enough in the scientific manner of hypothesis, deduction, and experimentation to let us be certain about it one way or another. The biophilic tendency is nevertheless so clearly evinced in daily life and widely distributed as to deserve serious attention. (p.85)

In his TED Prize speech, Wilson (2007) proposed a solution for this lack of official scientific proof or support called the *Encyclopedia of Life* which I will go into in greater detail later on in this study.

We surround ourselves on a daily basis with static images of nature or with actual living organisms. In his book, *A Sense of Order: A Study in the Psychology of Decorative Art*, art historian Ernst Gombrich (1979) wrote, "Usually we walk through life without paying much attention to the infinite variety of patterns and decorative motifs which we encounter all around us, on fabrics, wallpaper, etc." (as cited in Flannery, 2005, p. 239). Decorative art, as Gombrich believes, has the ability to consciously draw inspiration from nature and translate that inspiration in a way that does not overwhelm the viewer but finds a way to dwell in the viewer’s subconscious (as cited in Flannery, 2005, p. 239). Beyond the incorporation of decorative art pieces inspired by nature in our living and working environments, Flannery (2005) notes many individuals surround
themselves with actual living organisms, housing pets and plants within the spaces in which they live and work (p. 239).

The practice of surrounding ourselves with nature-inspired motifs dates back centuries. Almost all cultures, both ancient and current, have incorporated both plant and animal ornamentation in their daily surroundings. Cave paintings indicated visual reminders of species, although these were possibly associated to with hunting. Murals found in Ancient Persia and Egypt, Japanese screens, and Greek and Roman relics, to name a few, all possessed depictions of natural scences and species. Those who lived during the Victorian Era felt a strong desire to incorporate non-human living species in the home. Flannery (2005) writes, "In Victorian times, there was a great interest in bringing the organic home as technological advances had coupled with an interest in natural theology – the belief that learning about God's creatures brought one closer to God" (p. 240). This yearning to remain in close proximity to the natural world in an advancing built environment led to the development of the Wardian case, invented by Dr. Nathaniel Bagshaw Ward in the 19th century. These cases could

*Figure 1. Wardian cases.*  
*Figure 2. Victorian-Inspired greenhouse.*
accommodate tiny plants and animals. Naturally this concept progressed, in conjunction with the ability to mass produce glass and metal framework, into the present-day terrarium and glass aquarium and eventually manifested itself into larger ideas, such as the greenhouse. A significant amount of emphasis was placed on nature-based interior adornment towards the end of the 19th century, mainly motivated by religion. By the 20th century, decorating for religious purposes began to fade as emphasis was placed on ethics and specifically on safeguarding and improving the natural world (Flannery, 2005, p. 240).

Paul Shepard (1982), in his book *Nature and Madness*, explores the role plants and animals play in the evolution of the human species. Plants, in particular, provide a palpable experience for the caretaker. Persistent and careful maintenance is necessary in order for both indoor and outdoor vegetation to flourish. Interaction with both plants and animals are beneficial to human development, however, the effects of these interactions on the advancement of the human mind varies (Flannery, 2005, p. 242). Wilson (1984) declares, “I will make the case that to explore and affiliate with life is a deep and complicated process in mental development” (p.1). In *Green Nature/Human Nature: The Meaning of Plants in Our Lives*, Charles Lewis (1996) discusses the sentimental impact plants have on human life. Lewis refers to both the physical and emotional benefits of surrounding oneself with vegetation. In medical settings, foliage has proven to possess a remedial significance. In areas of recreation, plants encourage play and an overall active lifestyle. Humans benefit greatly, both physically and mentally, from gardening, playing soccer on
a lush field, or even by simply caring for indoor plants (as cited in Flannery, 2005, p. 242).

Wilson (1984) argues that human beings attempt to recreate landscapes they have seen in real life or indirectly through prints, paintings, or other forms of media. We carefully landscape our lawns, plant trees and flowers, and create indoor gardens that mimic the landscapes that have consciously or subconsciously influenced us (as cited in Flannery, 2005, p. 241). Windows frame views of changing landscapes and outdoor environments, such as uncovered patios, allowing us to spend time digesting several natural occurrences at one time. In studies conducted by Mihaly Csikszentmihalyi and Eugene Rochber-Halton (1981), many individuals cited plants as one of the top three most essential belongings housed within their living spaces (as cited in Flannery, 2005, p. 242). These findings further solidify the human connection to vegetation and natural life (Flannery, 2005, p. 241-242).

In his book Traces of Omnivore, Shepard (1996) writes about his belief that what Wilson (1984) refers to as human beings’ innate connection to the natural world is actually a result of standard human development. Wilson believes humans possess a genetic predisposition to connect with the natural world, whereas Shepard argues this bond with nature is a result of a typical upbringing in a world that is not largely artificial. For centuries, human beings have developed in an environment overflowing with other organisms, plants, and animals. Constant human contact with the natural environment plays a predictable role then in human advancement (as cited in Flannery, 2005, p. 242).
As cities and towns expand and technology continues to advance, it is no surprise that the human population is becoming more and more estranged from our natural surroundings. As a result, indoor representations of nature are becoming increasingly important. These translations of the natural world will never replace the unique world we have a privilege of inhabiting. They may, however, aid in maintaining human beings psychological and emotional connection to nature and sustain our desire to help protect the native organisms, plants and animals that populate the earth (Flannery, 2005, p. 242). Regardless of the strength of the argument for biophilia, Wilson (1984) promotes any discussion of the hypothesis because he believes it will only drive people towards safeguarding nature (as cited in Flannery, p 242). In addition to representations of nature, Wilson (2007) proposed a solution in defense of the natural world in his TED Prize speech, “I wish that we will work together to help to create the key tool we need to inspire preservation of earth’s biodiversity: The Encyclopedia of Life.” In 2008, The Encyclopedia of Life became a reality ("EOL history," n.d.).

THE ENCYCLOPEDIA OF LIFE

In his TED Prize speech, Edward O. Wilson (2007) urged his audience to step up and play an active role in what has become a pressing dilemma throughout our World. He describes this dilemma as a "juggernaut":

The human juggernaut is permanently eroding Earth’s ancient biosphere by a combination of forces that can be summarized by the acronym “HIPPO,” the animal hippo. H is for habitat destruction, including climate change forced by greenhouse gases. I is for the invasive species like the fire ants, the zebra mussels, broom grasses
and pathogenic bacteria and viruses that are flooding every
country, and at an exponential rate -- that's the P. The first
one in "HIPPO," is for pollution. The second P is for continued
population, human population expansion. And the final letter is O,
for over-harvesting -- driving species into extinction by excessive
hunting and fishing. (Wilson, 2007)

Wilson (2007) warns his listeners that this destructive force has the potential to
eradicate at least 50 percent of Earth's existing species by the end of the 21st
century. A loss like this could be compared to that of the Mesozoic Era. Without
insightful knowledge of our natural environment we will not be able to effectively
and efficiently monitor its organisms, plants, and animals in order to fight against
another episode of extinction. Wilson (2007) therefore proposed a group effort
to obtain as much information about the Earth's species as possible which would
then be compiled into an encyclopedia of sorts.

A desire to acquire and maintain records of Earth's species online
preceded Wilson's 2007 proposition during his prize lecture at TED. At first the
Encyclopedia of Life (EOL) seemed to be just simply an inspired idea. Edward O.
Wilson's speech, however, served as just the right launching pad for this online
database to transcend idea and become a reality. The Field Museum, Harvard
University, the Marine Biological Laboratory, Missouri Botanical Garden and the
Smithsonian Institution became the five founding organizations aiding in the
laying of the initial groundwork for this database ("EOL history," n.d.). The stated
mission of EOL is, "To increase awareness and understanding of living nature
through an Encyclopedia of Life that gathers, generates, and shares knowledge
in an open, freely accessible and trusted digital resource" ("What is EOL," n.d.). This mission statement was developed in response to what had become a growing issue of information displacement. Any research conducted on found organisms, plants, and animals was spread out among various written and unwritten forms. Scientists and avid researchers could greatly benefit from a single database where this compiled information could be found. If these scientists and researchers were able to perform their jobs more efficiently, architects, designers, engineers and inevitably the population of the entire planet would reap the benefits of learning from Earth's most advanced living forms ("What is EOL," n.d.).

Knowledge of species that hold higher priority amongst the world's population are of greatest interest to those directly involved with The Encyclopedia of Life. Those at the forefront of EOL, who are responsible for communicating this compiled information, continually track their most read web pages and current events in an effort to remain updated on the demands for this knowledge. They have developed two running lists with the findings from their prioritized research: the Red Hot List and the Hot List ("What is EOL," n.d.). The Encyclopedia of Life staff provides the following description for the Red Hot List:

The RedHotList, our inventory of taxa deemed the most urgently needed, currently numbers about 2000 taxa, including the 100 worst invasive species on Earth, your most frequent searches on EOL, our most important food species and several other categories. ("EOL content priorities," n.d.)
The Hot List is much larger but is still comprised of species generating the most interest to date. There are nearly 80,000 taxa included in this growing list. There will never be an end to the expansion of knowledge of newly discovered or known organisms, and as a result, both lists will continue to evolve as the years progress. The EOL staff encourages the users of their site to continue to ask for information and to help provide more information so that the site may continue to flourish and prove to be both enlightening and efficient ("EOL content priorities," n.d.).

The in-depth exploration of biophilia has inspired researchers and academics, such as Stephen R. Kellert and Janine Benyus, to propose the incorporation of this knowledge into the built environment. Kellert (2008) explored this idea, specifically, in what he refers to as biophilic design. Benyus (1998) takes this concept one step further in the up and coming field of biomimicry. Not only do biomimics incorporate the hypothesis of biophilia into their practices, but architects, engineers, and designers invite biologists to sit at their tables to aid in developing solutions based on the successful aesthetic and functional characteristics of Earth’s species. Wilson, Kellert, and Benyus acknowledge that these concepts may be fairly straightforward, but the execution of these proposals is proven to be much more complex in an ever changing world filled with so many variables and inconsistencies. An enormous amount of research and effort by the human population is necessary to achieve successful results. If successful, these theories and practices have the potential to drastically and positively alter the condition of the Earth and its inhabitants.
CHAPTER THREE

BIOPHILIC DESIGN

Following The Biophilia Hypothesis (1995), a book co-written with Edward O. Wilson, and Building for Life: Designing and Understanding the Human-Nature Connection (2005), Stephen R. Kellert wrote Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life (2008). It is in this book that Kellert (2008) coins the phrase biophilic design. This term describes the effort to adopt and apply the ideas behind Wilson's theory of biophilia in the planning and transforming of man-made buildings and interior spaces. This is not an easy task, however, due to our lack of knowledge of or ability to calculate the human affinity to assign levels of importance to nature (Kellert, 2008, p. 3). Wilson (2008) supports Kellert's efforts to develop and further encourage the practice of biophilic design. He believes architects and designers must adopt the principles of this practice in order to bridge the gap between science and technology and art (as cited in Kellert, 2008, p. 26).

HISTORY

As stated in the previous chapter, Wilson (1984) believed human beings' innate tendency to remain connected with "natural systems and processes" was rooted in their genetic composition (as cited in Kellert, 2008, p.3). Kellert (2008) further explains this theory developed as a result of human beings "having evolved in a largely natural, not artificial or constructed, world" (p.3). Regardless of the degree of significance assigned to nature by various individuals, our
corporeal and psychological health is dependent upon our level of interaction with nature. The design of man-made surroundings can either foster this relationship or create a separation between nature and man, ultimately decreasing man's quality of life (Kellert, 2008, p.4).

In his Building for Life: Designing and Understanding the Human-Nature Connection book, Kellert (2005) provided the following summarized findings as a testimony to the benefits of biophilic design (as cited in Kellert, 2008, p. 4):

- Interaction with the natural world has proven to be therapeutic and accelerate restoration of body to healthier states
- Human beings who preside in or near areas comprised of prominent natural landscapes testify to a lowered number of issues surrounding their personal and societal well-being
- Employees experience heightened levels of productivity, decreased levels of anxiety, and increased incentive as a result of the incorporation of non-artificial illumination and aeration in the corporate environment
- Cerebral functions involving a necessity for attentiveness and ability to recall information are directly associated with experiences among natural occurrences
- Children are better able to grow and flourish in highly vegetative environments
- Markings and indications that target the human sense and are influenced by nature evoke a purposeful, cerebral response
• Neighborhoods with premium natural surroundings, regardless of level of wealth, experience higher levels of satisfaction with various elements comprising their living conditions.

These are only a select few statements supporting the significance of frequent and extended human interaction in and around natural environments. The two basic dimensions of biophilic design play a fundamental role in each of these findings (Kellert, 2008, p.4).

DIMENSIONS & ELEMENTS OF BIOPHILIC DESIGN

As noted by Kellert (2008), there are two dimensions of biophilic design: an “organic or naturalistic dimension” and a “place-based or vernacular dimension”. The first dimension refers to outlines and configurations that embody the qualities and characteristics of natural occurrences either in a straightforward, circuitous, or representative manner. Honest and straightforward exposure with nature is indicative of unguided experiences with natural systems and occurrences. Circuitous exposure to natural environments involves continuous action by individuals to sustain and nourish living entities. Representative exposure requires no interaction with human beings or the natural environment, instead, nature is viewed by means of prints, paintings, digital media, and various other media (Kellert, 2008, p. 5-6).

The second measurement of biophilic design is a direct result of the significance assigned to various man-made and natural environments by individuals. These places of significance play a key role in developing personal and shared characteristics and tendencies. As a result, non-living substances
feel authentic and natural. René Dubos (1980), a microbiologist and environmentalist, disputed:

People want to experience the sensory, emotional, and spiritual satisfactions that can be obtained only from an intimate interplay, indeed from an identification with the places in which (they) live. This interplay and identification generate the spirit of the place. The environment acquires the attributes of a place through the fusion of the natural and human order. (as cited in Kellert, 2008, p. 6)

The two fundamental dimensions of biophilic design correlate with six biophilic design elements: environmental features, natural shapes and forms, natural

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<td>Spatial harmony</td>
<td>Spirit of place</td>
<td>Information and cognition</td>
</tr>
<tr>
<td>Inside-outside spaces</td>
<td>Avoiding claustrophobia</td>
<td>Fear and awe</td>
</tr>
</tbody>
</table>

patterns and processes, light and space, place-based relationships, and evolved human-nature relationships. Cumulatively, these six design elements establish over 70 individual design traits as listed in Table 1 and as discussed in a great amount of detail by Kellert. These elements and attributes, however, do not comprise an exhaustive list but a list that will continually change and develop over time in response to a growing understanding of these concepts and guiding principles (Kellert, 2008, p. 6). In order to successfully make use of these elements and attributes in the practice of biophilic design, Kellert (2008) and Dubos (1980) believe there must be a common understanding and respect between man and nature along with a willingness to grow and adapt together. Successful efforts in adaptation and in applying various elements and attributes of biophilic design can help to alleviate stress, reduce pain, and increase productivity.

PHYSICAL & PSYCHOLOGICAL BENEFITS OF BIOPHILIC DESIGN

Studies, specifically those conducted in healthcare environments, have proven that direct or indirect exposure to nature can help to alleviate stress and feelings of irritation in patients. Research has shown that hospital patients confined to their beds and elderly residents in extended care facilities demonstrate a strong inclination for direct views of natural environments with the presence of both vegetation and wildlife. These same patients verbalized displeasure of views primarily composed of man-made structures (Ulrich, 2008, p. 91-92). A study by Katcher, Segal, and Beck (1984) discovered that the presence of an aquarium in a waiting room for patients undergoing dental surgery aided in lowering levels of anxiety and increasing patients' willingness to comply to surgeons' instructions during procedures (as cited in Ulrich, 2008, p. 92). Similarly,
research conducted by Heerwagen (1990) indicated dental patients provided with visualization of nature scenes through murals showed less anxiety than when the landscape was removed from the waiting area (as cited in Ulrich, 2008, p. 92). In Albany, New York, at the Prime-Care Physicians Clinic, Henry Domke, an endorser of nature images in healthcare settings, created a panoramic image of a lush landscape for the facility’s waiting room. Domke, a family practitioner and artist, chose this specific mural to help distract patients. He says, "The idea is to give patients a positive distraction, something to take their attention away from their circumstances. Images that invite patients to literally step inside the scene are optimal" (as cited in Walker, n.d.). Murals, however, are not the only media form providing beneficial indirect experiences with nature. Wall-mounted televisions playing natural scenes captured on film helped to lower high blood pressure levels in anxious blood donors (Ulrich & Gilpin, 2003; as cited in Ulrich, 2008, p. 92). Yet another study demonstrated lower levels of stress and agitation in patients suffering from dementia, including those with Alzheimer's disease, when surrounded with rendered nature illustrations and recordings of noises extracted from nature (Whall et al., 1997; as
cited in Ulrich, 2008, p. 92). Domke was eventually forced to choose between practicing art or medicine. He chose art and declared, "The key goal of art in the health care system is to reduce stress. And that reduction of stress can contribute to the healing process, but the whole approach is very alien to most people in the art world. Picking art for the way it functions ... what a weird idea" (as cited in Walker, n.d.). By choosing art, Domke was able to indirectly practice medicine as well. Further exposure to these natural elements can also help to reduce pain experienced by patients in healthcare settings (Ulrich, 2008, p. 92).

It is easily suggested, and generally accepted, that nature has the ability to decrease stress and provide distraction for its viewer, but what can be said about nature's influence on pain? The theory that best exemplifies an understanding of pain is the gate control theory (Melzack & Wall, 1965, 1982; as
cited in Ulrich, 2008, p. 93). Ronald Melzack and Patrick D. Wall’s (1965, 1982) gate control theory found:

... neural structures or mechanisms in the spinal cord act as a gate in the transmission of sensory input or pain impulses through the spinal cord to the brain. When the gate is open, impulses flow to the brain and pain is experienced. When the gate is closed, pain impulses are inhibited from reaching the brain and pain is diminished or not felt. A key premise of gate control theory is that the gate can be closed by messages that descend from the brain and are influenced by psychological or emotional factors (as cited in Ulrich, 2008, p. 93).

Stress, as well as feelings of hopelessness and pessimism, can open the gate, whereas, distraction, positivity, and meditation lessen anxiety by closing this metaphorical gate. Theoretically if nature-rich environments are able to sidetrack and appease individuals experiencing painful sensations, their internal gate should close (Ulrich, 2008, p. 93). There is a second known theory that supports the idea of nature views decreasing feelings of pain: the distraction theory (Ulrich, Zimring, Quan, & Joseph 2006; as cited in Ulrich, 2008, 93-94).

Britton W. Brewer and Paul Karoly (1989) describe distraction as “concentrating on aspects of the environment that are outside onself” (as cited in Ulrich, 2008, p. 94). The theory further proposes that human beings have a limited amount of conscious attention. When an individual undergoes any feeling of pain, this sensation occupies the majority of this perceivable attention (Brewer & Karoly, 1989; as cited in Ulrich, 2008, p. 94). By providing patients with
a scene inspired by nature that allows them to concentrate on something translated as positive or relaxing within the brain, they will be less likely to succumb to feelings of pain in their conscious attention. As the level of distraction increases, greater and more frequent results may be observed (McCaul and Malott, 1984; as cited in Ulrich, 2008, p. 94). Although it is true that both negative and positive stimuli may successfully distract an individual from pain, the success rate for the reduction of pain through distraction is higher when the subject is presented with positive images (Wied & Verbaten, 2001; as cited in Ulrich, 2008, p. 94). This concept thereby supports the proposition that natural scenery is likely to diminish feelings of pain (Ulrich, 2008, p.94).

The first study on the effects nature has on pain discussed by Roger S. Ulrich (1984) involved patients recovering from abdominal surgery. Patients were assigned identical rooms; however, some patients were provided rooms with an exterior view of trees, while others were forced to peer out their windows at a brick wall. Not surprisingly, patients with the
nature view experienced less pain, as was evident in their decreased intake of powerful pain medications compared to those with the view of the brick wall. The patients provided with the natural scene also experienced abbreviated periods of post-operative care, less evidence of continuing sickness, and improved emotional health. (Ulrich, 1984; as cited in Ulrich, 2008, p. 94). Ulrich (1984) wrote, "Art is very powerful in hospitals. These are not museum situations or peoples' homes where they have control" (as cited in Walker, n.d.).

Research conducted by Ulrich and his colleagues (2006) on patients who had undergone heart surgery showed the control group presented with an image of a “spatially open, well-lighted view of trees and water” were not as likely to experience a noticeable level of stress or feel the need for frequent doses of strong pain medications as patients viewing an abstract image or no image at all. Levels of discomfort or anxiety in patients presented with images of a “spatially enclosed and shadowy forest setting” were not significantly altered. In addition, those staying in rooms with images of abstract, rectilinear forms suffered worse results than patients with no nature views (as cited in Ulrich, 2008, p. 94). This study, along with similar conducted research, supports the distraction
and gate control theories’ conclusion that more captivating encounters with nature can provide a higher level of distraction and ultimately aid in the reduction or alleviation of pain and anxiety in the viewer (Ulrich, 2008, p. 95). Incorporating natural elements has not only proven successful in healthcare environments but in corporate environments as well.

In working environments it is crucial for windows to act as doors, but what does that look like? Vivian Loftness and Megan Snyder (2008) write:

Biophilic design recognizes that

the line between indoors and outdoors must be rethought;

that indoor rooms must communicate with outdoor rooms;

that windows must become doors.

Biophilic design must be achieved in

a regionally rich design paradigm,

with an understanding of the physiological and psychological,

the mechanisms and the boundaries,

through a transdisciplinary design process. (p. 119)

“Windows as doors” ensure that a building’s occupants maintain a constant connection to the outdoors and the richness of textures, sights, noises, and smells that nature has to offer. Exterior views, as previously stated, have the potential to motivate and encourage the users of a given interior space. Loftness and Snyder (2008) believe these windows, when utilized as portals, “define the spirit of place, central to timeless architecture” (p. 119). There are still arguments for and against the necessity of the incorporation of a certain degree of daylight in the built environment; however, there is little argument surrounding the undeniable
benefits that result from the purposeful incorporation of natural elements within the built environment (Loftness & Snyder, 2008, p. 119-120).

Studies have proven the considerable effects views of natural settings have on the health and productivity of a building's occupants. One-hundred customer service representatives who worked in the call center at the Sacramento Municipal Utility District (SMUD) were included in a field study performed by the Heschong Mahone Group (2003). In this study, worker productivity was tracked according to the influence windows and daylight had on these employees. Results showed a 6-7 percent improvement in call ratings,


where duration and efficiency of call were variables (as cited in Loftness & Snyder, p. 119). Employees at the ING Group Headquarters in Amsterdam, The Netherlands, were also found to experience higher levels of productivity and

![Figure 8. ING Group Headquarters, Amsterdam, The Netherlands. Retrieved from http://www.meyer-vanschooten.nl/project/detail/4/ing-house](http://www.meyer-vanschooten.nl/project/detail/4/ing-house)
overall improved moods while occupying the new building. Meyer en Van Schooten Architecten (n.d.), the architecture firm behind this nature driven design, explained:

Transparency, innovation, eco-friendliness and openness were the main starting points for the design of the new ING Headquarters. The double-skin facade allows natural ventilation of the offices without admitting traffic noise. The atmosphere of the interior is richly varied and features a balance of open and sheltered spaces. Atriums, loggias, and gardens, both internal and external, are distributed throughout the building at various levels. In addition, the building was built on stilts to prevent any blocked views by the neighboring motorway.

This high level of transparency allows the building's occupants to remain in indirect and/or direct contact with the natural environment. This direct and/or indirect contact with nature is crucial in human development, as previously discussed in Chapter 2. Applying the characteristics of biophilia within the built environment creates a more enjoyable living, working, playing, and healing environment.
CHAPTER FOUR

BIOMIMICRY

Biomimicry is a current attribute of the biophilic design element referred to as natural shapes and forms. Janine Benyus is at the forefront of the biomimicry movement. She describes biomimicry as "the act of learning from nature, borrowing designs and strategies that have worked in place for billions of years" (Benyus, 2008, p. 28). On the surface biomimicry is seemingly a very simple concept. Designers, architects, and engineers can define a functional issue they are having and "begin conversation," as Benyus (2008) refers, with natural organisms and processes to begin to define an answer (Benyus, 2008, p.29). The end result may not appear to be visibly organic but the underlying solution is very much tied to our natural world (p.29).

HISTORY

Benyus (1997) refers to followers of biomimicry as biomimics, those who learn from natural organisms and processes instead of trying to instruct them. The biomimics, initially, were not easy to find. She briefly describes her experiences in a major and at a university where there was no recognized effort to learn from nature. Academics and educators continually relied upon human understanding to solve issues for which nature had already prescribed the solutions (Benyus, 1997, p. 3-4).

In a lecture given at TED, Benyus (2005) discussed a trip she and her colleagues had taken to the Galapagos Islands with wastewater treatment
engineers. The engineers were facing a very specific design challenge: scaling. At first the engineers did not understand the logic behind taking a trip to the beach, Benyus explains:

And some of them were very resistant, actually, to being there. What they said to us at first was, you know, we already do biomimicry. And we said, well, that’s not exactly being inspired by nature. That’s bioprocessing, you know; that’s bio-assisted technology: using an organism to do your wastewater treatment is an old, old technology called “domestication.” This is learning something, learning an idea, from an organism and then applying it.

At this point in the story, the engineers were still lacking insight into the true meaning and application of biomimicry. Benyus and her colleagues continued on to explain how shells and seawater work together to provide the exact solution the engineers had been seeking for so long. Nature had already worked out the kinks and found a way to take preventative measures against scaling (Benyus, 2005). The list of examples of biomimicry in action seems endless; however, there are a multitude of species we have yet to discover and

Figure 9. Shells and seawater provide the solution for scaling in pipes.
depths of knowledge that have gone untapped regarding the species we do know. At a more recent TED conference, Benyus (2009) said:

If I could reveal anything that is hidden from us, at least in modern cultures, it would be to reveal something that we’ve forgotten, that we used to know as well as we knew our own names. And that is that we live in a competent universe, that we are part of a brilliant planet, and that we are surrounded by genius.

We, as humans, spend too much time trying to develop our own man-made solutions for the issues we are facing when nature already possesses the keys and is offering insight right before our eyes. Through movements, such as Biologists at the Design Table, developed by Biomimicry Guild, there has been a continuously growing number of successful case studies. The following case studies are a select few examples of these biomimicry successes. As we continue to learn from and grow a respect for the species we come into contact with on a daily basis, our world and the human population with reap the benefits (Benyus, 2005, 2009).

CASE STUDY #1: THE EFFICIENT KINGFISHER

The Shinkansen Train of Japan, although very fast, made a loud popping noise every time it would exit a tunnel. Local residents complained about the disturbances, leading chief engineer, Eiji Nakatsu, to look to nature for an answer. Is there any living creature that is able to pass between two contrasting elements quietly and efficiently? He found his answer in the kingfisher, which is able to move at high speeds and dive into a body of water to capture fish. Engineers modified the front of the Shinkansen train to appear and act similarly to the kingfisher’s beak. As a result, the train is quiet and able to travel at a rate that is 10 percent faster than it had prior to modifications, while increasing its level of electrical efficiency by 15 percent (“Transportation,” n.d.).

CASE STUDY #2: SUSTAINABLE BUILDINGS INSPIRED BY TERMITE COLONIES

![Figure 11. Architecture: Learning from termites how to create sustainable buildings.](http://www.biomimicryinstitute.org/case_studies.php)

In Zimbabwe, a surprising architectural solution emerged from what is typically considered an architectural adversary. The architects and engineers behind the Eastgate Building, a corporate complex, were strongly influenced by Macrotermes michaelseni. These specific termites are able to engineer mounds that are self-cooling. They are able to regulate the interior temperature of these mounds by one degree. Buildings account for 40 percent of all energy used by
the human population. By researching and utilizing features from these termite homes, the Eastgate Building uses 90 percent less energy than comparable buildings and has saved its owners over $3.5 billion to date ("Architecture," n.d.).

CASE STUDY #3: DOLPHINS AID IN LESSENING THE IMPACT OF TSUNAMIS


Dolphins have the unique ability to broadcast information over a far distance, a feat that has proven very difficult for human beings. By studying dolphins and their means of communication, EvoLogics, a high-tech company founded in Germany, has developed an underwater frequency system that creates early detection tsunami warning signals for countries along the Indian Ocean. Dolphins’ successful communication can be attributed to their utilization of varying frequency levels, which EvoLogics has carefully studied and adapted into their own engineering practices ("Human safety," n.d.).

HOK + BIOMIMICRY GUILD

In 2008, HOK joined forces with Biomimicry Guild to create more bio-inspired designs. It was then revealed that the two companies had actually begun collaborating in 2004 on various projects. An early collaboration was the "City of the Future" design competition ("HOK and Biomimicry," 2008).
Figure 13. Atlanta 2108, "City of the Future" competition sponsored by the History Channel.

The goal of this competition was to design the city of Atlanta, as it would appear in 2108, taking its current design into account along with ecological issues attributed to the city. Mary Ann Lazarus, HOK Sustainable Design Director, commented:

We believe biomimicry will not only help us significantly reduce the environmental impact of our projects, but also has the potential to help define a whole new sustainable standard for our profession. Because biomimicry addresses critical environmental issues at the habitat scale, it gives us lessons on how to achieve significant results even restorative outcomes at all scales. ("HOK and Biomimicry," 2008)

The design solution would make an attempt at reversing some of the damage done to the environment while devising a solution that will continue to allow this southern metropolis to thrive (Fox, 2008). A more current collaboration is the Lavasa Hill Station community in India which is under construction. This sustainable hill station, or second home community, will provide an innovative design solution to aid in the conservation of India's natural
ecosystems while meeting the daily needs of human life ("Lavasa Hill Station," n.d.). HOK and Biomimicry Guild are working together to create a community that works with its natural surroundings and generates a fresh outlook on life for its inhabitants. Benyus, co-founder of Biomimicry Guild, states:

Together with HOK, we are looking at what it means to be a bio-inspired company in the architecture space and I think the answer to that question is really going to be something new in the world. Because making a bio-inspired product is one thing; making a bio-inspired city begins to change the world. ("HOK and Biomimicry," 2008)

The working relationship between HOK and Biomimicry Guild was made possible through the development of the aforementioned Biologists at the Design Table (n.d.), the movement established by Biomimicry Guild, which helped meet the growing design demands of HOK’s clients.

BIOLOGISTS AT THE DESIGN TABLE

Biologists help to provide an in-depth understanding of our natural systems and species. This knowledge is invaluable to architects, designers, and engineers. Biologists at the Design Table (n.d.) strive to make available:
• Biologists who are uniquely adept at combing through nature’s R&D labs and translating nature’s strategies into strategies that effectively meet your company’s challenges.

• Biologists who are trained in the biomimicry design methodology and excel at helping develop products and processes which are sustainable, innovative, effective, cost-saving, and life-friendly.

• Biologists who move easily from biology to business, taking complex biological data and translating it into language digestible by any department, from marketing to R&D.

• Biologists who can be part of your company’s team from brainstorm to prototype, continually adding biological insight to the process.

• Biologists who have access to full-text scientific databases worth hundreds of thousands of dollars a year. This makes our research service fast, thorough, and highly cost-effective for clients.

To ensure quality and consistency of biological advice, Biomimicry Guild has developed a system of training biologists, ecologists, and naturalists in order to prepare them with the proper tools and to best make use of their knowledge and time with architects, designers, and engineers (“Biologists at the Design Table training,” n.d.).
CHAPTER FIVE

COLLOSPHAERA

Collosphaera came together in parts for me as I layered information collected over my years of studying and exploring in the Master of Fine Arts program at the Lamar Dodd School of Art. As I began to crystallize ideas, I was inspired by the notion of pursuing a "less traditional" interior design project. I wanted to transform a specific site, intentionally define space, and create a physical experience for the user. Honestly, I stumbled upon the theory of biophilic design while I was looking for a way to meld my interest in design with my fascination with the natural environment and specifically with the ocean. From a very young age I had a strong desire to grow up and become a marine biologist. Something about the vastness of the ocean, its unique wave formations, and an endless fascination with the multitude of treasures found beneath its surface left me always longing to be teleported to any location along the coastline. This fascination with the ocean struck a larger chord of curiosity that led me to explore the impact nature in general has on the built environment and ultimately how this interaction between the natural and the synthetic affects the users of these spaces. To what extent are we impacted by our natural surroundings? As users of a given space, do we respond more positively, work more efficiently, and find greater enjoyment in a space that adopts a certain degree of direct or indirect natural representation? How can we, as interior designers, create effective living and working environments with
consideration of the theories and principles of biophilia and biophilic design? These are the types of questions I began asking myself as I started conceptualizing and planning for the Master of Fine Arts 2012 Thesis Exhibition.

THE AESTHETIC OF APPEAL

Together, Wilson and Kellert (1997), explore various manifestations of biophilia in their book, *The Biophilia Hypothesis*. Both researchers admit that the argument for biophilia is not necessarily as convincing as the possible arguments against the hypothesis. Kellert (1997) writes:

...the human affinity for nature represents a collection of relatively weak biological tendencies. All the various strains of biophilia depend on adequate learning and experience – on a sufficient diet, that is, of individual opportunity and social support. Without repeated experience, the various strands of biophilia lie dormant and frustrated. Thus the different aspects of biophilia are best viewed as products of "biocultural" evolution – inborn tendencies shaped by the mediating influence of learning, culture, and experience. (p. 4)

Kellert’s (1997) main concern is for the biophilic urge, regardless of strength, to elicit a desire to demonstrate “respect and affection for the natural world” (as cited in Flannery, 2005, p. 242). He continues to explore this idea of a biophilic tendency and proposes there are five adaptive benefits that have led to the growth of an “aesthetic sensitivity” to the natural world, including: a view of harmony and striving after an ideal; perceptions of order and organization; a sense of sustenance and security; feelings of mystery and discovery; and
physical healing and mental restoration (Keller, 1997, p. 35). Kellert emphasizes the impact acquired knowledge and interaction has on these results.

The first aesthetic Kellert refers to is “a view of harmony and striving after an ideal”. In a chaotic and imperfect world, we tend to look towards images from nature to provide us with suggestions of an ideal. Color, texture, symmetry, and unity are a few examples of the elements of natural design that we yearn for, find hope in, and seek to adopt in order to create harmony in our own lives. Nature’s insight into the systematic duplication of shapes and patterns to develop idyllic end results is something to be researched in depth by the human population and adopted, in part or whole, by architects, designers, and engineers. For example, innovators have taken inspiration from the form, movement and texture of sea mammals, such as the dolphin and shark, in order to improve our ability to travel efficiently through water. Nature has already provided us with the ideal answer; we just need to take the time to observe and interpret these harmonious examples (Kellert, 1997, p. 36).

This perception of a straightforward system can be advantageous to human life, as Keller (1997) explains in the aesthetic, “perceptions of order and organization”. He writes, “By discerning a unifying structure in the natural world, we invest life with meaning and integrity rather than randomness and chaos” (p. 37). Keller suggests that natural forms that have been abstracted, or are being viewed in a different context, can be disorienting and not as impactful to the viewer. However, when these forms are pieced back together, they become a cohesive whole and are ultimately found to be more attractive and intriguing.
Essentially, the appeal of this aesthetic becomes stronger with less evidence of chaos (p. 40).

The third aesthetic of appeal is "increase sustenance and security". This concept surrounds the theory that people desire clear, unobstructed views. We choose to depict vast landscapes in paintings and capture this open scenery in photographs and on film. We always search for a room with a view when traveling and find leisure in unimpeded environments. On a whole, the human species prefers a high and unhampered vantage point from which they live, work, and play. From this point of view, an individual is more likely to feel safe and provided for (Kellert, 1997, p. 40-41).

Kellert (1997) discusses nature's ability to provide healing and mental restoration for those who come into direct or indirect contact with it (p.45-46). He notes, "In addition to its capacity to inspire, instruct, and sustain, natural beauty appears to comfort and restore, especially during moments of stress and dysfunction" (p.45). Various studies, as discussed in Chapter 3, have proven nature's ability to advance healing within healthcare environments. This particular benefit, specifically, supports the idea of genetically encoded biophilic tendencies (Kellert, 1997, p. 45).

Finally, nature's endless abundance of texture, pattern, shape, and motion creates a stimulating atmosphere that elicits a heightened sense of intrigue in its viewer. Layering of information generates a greater amount of interest and encourages questioning and exploration (Kellert, 1997, p. 44-45). Exploring even an abstracted version of natural forms can create a similar,
Islamic Geometry & Bio-Inspired Forms

Introduction

Islamic geometry is a rich and intricate field of study that has influenced various aspects of art, architecture, and science. In this chapter, we will explore the geometric concepts in Islamic Art, focusing on the integration of the compass and ruler method used in traditional Islamic design (El-Said, 1976). Geometric concepts in Islamic art have evolved from ancient Egyptian methods. The peg and cord method, based on the initial rope measurement (Figure 6), could achieve measurements for varying proportions based on the initial rope length (El-Said, 1976). By folding the rope, an individual could attain measurements for creating structures such as the Great Pyramid of Giza, 2500 BC (El-Said, 1976, p. 3). Through the use of the peg and cord method, they were able to create circles and straight lines on sand to create structures such as the Great Pyramid of Giza. Egyptians perfected the technique of tying knots to form patterns when assembling the pyramids. In time, rope was replaced by specific measurements, and Egyptians replaced the symbols of the ancient numeral system. In ancient Egyptian geometry, symbols were used to indicate the quantitative significance of each individual number. Later, this alphabet evolved into numerous symbols and design patterns. Throughout history, a numerical decimal system did not exist.
The diagram marks the triangle, square and pentagon, respectively, at the corners of the circle into 3, 4, 5 equal portions (El-Said & Pormann, 1976, p. 3). By connecting the dividing marks made along the circle's circumference, the most frequently used polygons in Islamic decoration were developed by dividing this dividing a guiding circle into an equal number of parts. Straight lines were used through the use of a compass, ruler and the circle, as a guiding geometric method, reminded, decimal system. This method, complete in itself, reminded calculations such that, after the development of mathematics, the shape needs without resuming to complicated mathematical intricately and measure, based on the circle, a perfect method to man has found through the utilization of geometry (meaning...
portion of the ocean's floor in what scientists refer to as radiolarian ooze [Berger,
mineral skeletons. However, layers of their skeletal remnants cover a significant

Figure 17. Ernst Haeckel, Colosphaera (1867), front.

size. Smaller radiolarians are organisms that generate complex
produced a series of finely detailed copper engravings of various radiolarians
in his book Die Radiolarien (Rhizopoda Radiolaria) (1867). Ernst Haeckel
high relief creates interest through resulting cast shadows (Jones, 1978, p. 148).
create visual negative and positive spaces while the implementation of low and
endless range of pattern combinations. Contouring colors used in the patterns

Figure 18. Once again, the radiolarian characteristics, Muslim artificits were able to attain a diverse and seemingly
made to scale and the implementation of materials with varying color and
these perfectly symmetrical manipulated forms in combination with alterations
bottom row) (El-Said & Parramon, 1976, p. 41. Through the careful repetition of
subdivisions are achieved resulting in 12, 16 and 20 identical components (Figure 7.
by placing another division mark between the 6, 8, 10 marks, the original 3, 4, 5
doubled by bisecting the sides of the respective polygons (Figure 7, middle row).
of Radiacl”. I aspire to create visual interest through varying color and texture.

The mineral skeleton of the coral polyp in combination with the unique
individual units composing the larger forms of Collospheroid Initiative

Starting point for my installation.

To layer creating completely new and intriguing compositions served as the
of great interest as my explorations progressed. Their unique form and tendency
nothing to get unwasted (Vriplis, n.d.). Those intricate mineral skeletons became

This Lifecycle of radiolaria is a prime example of nature’s resourcefulness allowing

Ocean floor where they settle and eventually transform into sedimentary rock.

Figure 18. Annelso Voids Radiolarian Ooze (2009). 109.72 X 80.7/ Paper fold.

When radiolaria shed their transparent skeletons, they fall to the bottom of the


for artists” (p. 239). Annals Recoils, a sculptor from California, produced a work
accomplished artist as well as a scientist; intended this as a sourcebook of ideas
Heeckeren’s prints, Maurice C. Proust’s. (2005) comment, “Heeckeren, who was an

12327]: Commenting on Heeckeren’s Art Forms in Nature (1974), a compilation of
points based on radial symmetry. For inspiration on the repetition of forms, inspired by nature and translated through geometry, devising all major attempts to create a harmonious and methodical repetition of forms achieving a more rewarding existence. (p. 36)

collection—methodology, through mimicry and ingenuity, for results in the human experience. This ideal provides a template for prospects, and color may be employed to produce analogous configurations of line, space, texture, light, contrast, movement, the belief and sometimes the understanding of how certain discerning beauty and harmony in the natural world may advance pathways of success in a multiplicity of shapes and forms. By design model. These environmental attributes suggest proven aesthetics of nature as a kind of monumental

grote:

Muslim artists in their creation of surface decoration, Stephen R. Keller (1997)

and by intentionally implementing solids and voids, similar to the practice of

Figure 21 (above right). Decorative detail of Byzantine mosaics of the Cathedral of St. Mark, Venice. Figure 20 (above middle). Close-up detail of purple and green enamel on gold, 15th century. Figure 19 (above left). Enamel panel, cloisonné, Germany (15th century). Print.
Islamic design.

I researched various coral configurations and geometric patterns in...
color palette for the print found in the interior of my installation. In addition to naturally found in the ocean, I looked to underwater scenes to establish the forms comprising my installation are based on forms
Blues and greys.

Systematic interpretation of bright colors set within a field of naturally derived and levelwood, which I believe the plant possesses, and also through the colors, nearly water, and the absence of predeators. (p. 41)

Cascading waterfalls, fountains, and flowers or parabolic settings of bright

on ideal landscape, people envision „tropical paradises„ of

of spring flowers on an outline of radiant leadage. Asked to depict

landscapes provoke such much aesthetic pleasure as the blossoming

brilliant reds, oranges, purples, yellows, and blues... Few

most people gravitate to horizontal compositions marked by
gardens and flower arrangements emphasize shape over color, but

connots the greater likelihood of encountering food... Some

association of environment and security. Bright hues frequently

even our preference for bright colors in nature reflects this

explanation of the effects of bright colors on the human psyche:

refers to as an area of „potential evolutionary advantage„ provides an

underwater coral reefs, increased sustenance and security what Kellert (1997)

water, I aspired to capture glimpses of bright colors similar to those perceived in

the various hues of blue and grey visually interpreted through the medium of
attach adjacent rows to one another.

secured by beaded nylon security ties. These same ties were used to

HP Everyday Matte Polypropylene. Each unit upon assembling was

print. All printing was completed on an Epson large format plotter onto

maintaining a certain level of transparency to support the underlying

core hobbled together, creating a more three-dimensional form while

were used. The matte film was utilized on the outer layers of the units that

combination of HP Everyday Matte Polypropylene and HP Matte Film

Collasphered is composed of 1110 multi-layered laser cut units. A

PROCESS
allowed me to calculate the fully assembled diameter of the top of each.

calculate the circumference of each of the larger forms which then

diameter. Once I established this individual unit diameter, I was able to

print (Figure 30). The top unit size of each of the larger forms is 0.875 in

specific layout in regards to placement of individual positions of the interior

the larger forms. This number assignment also allowed me to uphold a

help maintain a specific size progression that would inevitably help shape

units were assigned individual row and column numbers in an effort to

each unit is composed of two to three layers. Once assembled,

with while postprocessed before sending each job through the machine.

possible. To help minimize the amount of burning, I blocked both materials

ensure the least amount of burning and to create the cleanest and result

of 18 percent. These final settings were tested a multitude of times to

Figure 30. Epilog Legend JetCut.

643Hz. The matte film was cut at the same speed and frequency but at a power

job cut at a speed of 90 percent, power of 25 percent, and at a frequency of

drawings drafted into AutoCAD. The matte polypropylene was a vector-based

meticulously cut by an Epilog Legend JetCut laser cutting machine based on

As previously mentioned, each layer of each individual unit was
Figure 30. Column and row assignments.
forms could hang upon installation. cut on a CNC router in order to create a suitable structure from which the form. Once these diameters were calculated, large sheets of MDF were had done with the top to determine the diameter of the bottom of the bottom row of each overall form, I conducted the same calculations as I of the curve of the finished form. Once I had established a unit size for the row, working from top to bottom, I was able to control the exaggeration of the large forms. By varying the reduction percentage from the previous
and respond to the natural elements that exist just outside the adjacent angles and at varying times in the day. Colloquially, one could imagine experiences within this academic working environment. From various

defined space and for this act of exploration to positively impact their

| desired for the viewers to take time to pause and explore this newly

**Figure 22.** Select Images from 2012 MFA Thesis Exhibition Opening Reception.

... indirect connection to natural elements within the interior... was intended to transport the viewer from a typical setting and to elicit an interaction with the aforementioned theories, hypotheses, and practices. The installation...

In conclusion, this installation was an attempt to intersect nature.

**Conclusion**

**Chapter 6**
I believe this idea, which was simply a starting point, can be expanded and adapted to fit a multitude of situations and environments, and I am excited to discover the possibilities in its expansion.


Books:


Theohey, science, and practice of bringing buildings to life (p. 270).


Hypnosis for the reduction of anxiety and discomfort during dental surgery.

sciences and practice of bringing buildings to life (p. 87-106). Hoboken,
Keller, J.H. Heerwagen, & M.L. Macar (eds.) Biophilic design: The theory,
...

http://www.biomimicryinstitute.org/case-studies/case-

Transportation: Learning efficiency from Kingfishers (n.d.). Retrieved from
from http://california.mariposa-mpa.de/haeckel/radiolarien/

http://www.storror.org/stable/15111939

design theory. Design Issues, 13(3), 37-44. Retrieved from
Shepard, D. (1997). Biophilic and technophilic: Examining the nature/culture split in

http://dictionary.reference.com/browse/philia


http://video₹ps.org/video/980049632/


http://www.meyer-vanschooten.architecon.de/nt/4-ing-house

Meyer van Schooten Architecten. (n.d.) ING house. Retrieved from

971-979.


FRONT ELEVATION
NOT TO SCALE

SUITE GALLERY CEILING HEIGHT APPROX. = 14'-0"
APPENDIX B

Form A: HP Matte Mylar

A1b

A1a

A6

A2b

A2a

A7

A3b

A3a

A8

A4

A9

A5

A10
Form A: HP Matte Mylar (detail)

A9

A10
Form A: HP Matte Polypropylene, white

A11

A12

A12/A11

A7/A8

A10/A9

A13

A14
Form A: HP Matte Polypropylene, white (detail)

A13

A14
Form A: HP Matte Polypropylene, printed layer
APENDIX C

FINAL COLOR PALETTE (W/ CORRESPONDING RGB COLOR CODES, P. 67)
<table>
<thead>
<tr>
<th>BLUES/GREYS</th>
<th>BRIGHT BLUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. R: 151, G: 166, B: 170</td>
<td>47. R: 16, G: 35, B: 43</td>
</tr>
<tr>
<td>5. R: 201, G: 211, B: 212</td>
<td>51. R: 13, G: 84, B: 152</td>
</tr>
<tr>
<td>6. R: 218, G: 228, B: 229</td>
<td>52. R: 26, G: 190, B: 239</td>
</tr>
<tr>
<td>7. R: 81, G: 109, B: 115</td>
<td>12. R: 211, B: 212</td>
</tr>
<tr>
<td>18. R: 81, G: 109, B: 115</td>
<td>22. R: 18, G: 46, B: 60</td>
</tr>
<tr>
<td>33. R: 25, G: 100, B: 129</td>
<td>34. R: 31, G: 76, B: 125</td>
</tr>
<tr>
<td>47. R: 16, G: 35, B: 43</td>
<td>67. R: 142, G: 140, B: 130</td>
</tr>
</tbody>
</table>
APPENDIX D

DESIGN PROCESS 1

DESIGN PROCESS 2
DESIGN PROCESS 3

DESIGN PROCESS 4
DESIGN PROCESS 5

DESIGN PROCESS 6
APPENDIX E

INSTALL 1

INSTALL 2