IN(TER)VENTIONS IN NATURE

by Julie Chang
Bachelor of Science in Art and Design,
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JUN 0 5 1992
IN(TER)VENTIONS IN NATURE

by Julie Chang

Submitted to the Department of Architecture on May 8, 1992 in partial fulfillment of the requirements for the Degree of Master of Architecture.

(AN) ABSTRACT

If abstract means theoretical and an abstract is a summary of something's essence, then this is the abstract of this thesis:
This thesis is an abstract investigation which examines the duality between nature and culture in the design process.

If a thesis is an argument and the thesis is this very document, then this is the thesis's thesis:
The process of making and designing buildings in the landscape must respond directly and sensitively to the conditions of nature in terms of site, form, and material and at the same time accommodate specific human-cultural needs and criteria.

The main vehicle for this exploration is the design of two buildings in different natural contexts: one in the Arizona desert, the other on the New England coast.

The thesis will be presented in three parts. The first part is a general discussion of nature, culture, and design and relies on references and experiences to illustrate the argument. The second part presents the evolving process of understanding and designing on the two sites. The third part is an effort to consciously and critically assess the prescribed method of design.

Thesis Supervisor: Frank C. Miller
Title: Assistant Professor of Architecture

Thesis Critics: Fernando Domeyko, Shun Kanda, Maurice Smith
To my mother...

Annie Chang: The Place Where I Come From
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TITLE PAGE</td>
<td>001</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>003</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>006</td>
</tr>
</tbody>
</table>

## THE AGENDA

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>011</td>
</tr>
<tr>
<td>Vocabulary and Intention</td>
<td>012</td>
</tr>
<tr>
<td>Powers of nature</td>
<td>014</td>
</tr>
<tr>
<td>Site</td>
<td>016</td>
</tr>
<tr>
<td>Form</td>
<td>018</td>
</tr>
<tr>
<td>Material and Structure</td>
<td>020</td>
</tr>
<tr>
<td>Propaganda</td>
<td>024</td>
</tr>
</tbody>
</table>

## THE PROJECTS

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>027</td>
</tr>
</tbody>
</table>
## Reflection

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some Notes on Process and Diagramming</td>
<td>124</td>
</tr>
<tr>
<td>Abstracting the Site</td>
<td>126</td>
</tr>
<tr>
<td>Understanding Places</td>
<td>128</td>
</tr>
<tr>
<td>Diagraming Building Concepts</td>
<td>132</td>
</tr>
<tr>
<td>Assessing the Method</td>
<td>156</td>
</tr>
<tr>
<td>Some non-final notes</td>
<td>158</td>
</tr>
</tbody>
</table>

## Acknowledgements

163

## Illustration Sources

164

## Bibliography

165
INTRODUCTION

An important question:
To what extent should architecture be a personal and/or cultural invention, and to what extent should it be regulated by the forces of nature?

An indirect response:
As I attempt to consciously establish and clarify my own design agenda, I want to believe that the architectural decisions I make are linked to a wholistic understanding of the world and are not arbitrary or stylistic acts of personal expression. At the same time, I recognize that buildings are undeniably human inventions which provide us with a breadth of rich experiences and profound effects. While buildings should respect the processes of the natural landscape, they must simultaneously be understood as (wo)man-made objects/cultural products which are in direct tension with the environment.

It is this complex duality of invention and nature which is the focus of this thesis, to be explored through the design of two buildings in different natural contexts, one in the Arizona desert, the other on the New England coast. Two different sites have been chosen in order to study how different natural conditions may suggest different building behaviors. While the chosen places are not absent of (wo)man's presence, it should be noted that this design exploration does not directly engage the existing cultural components of the sites, but instead attempts to introduce new layers of culture which are founded in natural understandings of the places. The purpose is not to develop universal solutions/attitudes towards solving architectural problems, but as an advocate of nature, to explore a multiplicity of design approaches.

"After all anybody is as their land and air is. Anybody is as the sky is low or high, the air heavy or clear and anybody is as there is wind or no wind there. It is that which makes them and the arts they make and the work they do and the way they eat and the way they drink and the way they learn and everything." J. Stein: What Are Masterpieces, 1990
**VOCABULARY AND INTENTION**

*Nature* is an abstract term which we use to describe the world we live in. In addition to encompassing physical entities such as rocks, trees, and sky, nature is the order of the universe, the spirit and system which animates and regulates life.

While nature embodies all things and processes not made or controlled by (wo)man, *culture* might be defined as all the activities, inventions, and nonphysiological products of (wo)man that are not automatic or natural.

Nature and culture reciprocally affect one another: culture would not exist without nature, and nature changes and grows as a result of culture. In today's modern western society, (wo)man has exerted great power on the landscape, resulting in a diminishing role of nature on our lives.

The symbiotic approach to the problem of the city has an extremely simple and familiar premise. It is that man, in addition to his spiritual identity, is part of nature. He is a biological organism, subject like all other creatures to the laws of nature. This implies that he is constantly affected by his physical environment. Each of us is dependent on it, not only for the material necessities of life (though that is the one relationship most of us recognize) but for health and for the balanced functioning of our senses, and ultimately for emotional well-being. The subjective relationship to the environment—how it affects our senses—is the one we know the least about; but we are beginning to study it and recognize its importance.

J. B. Jackson: *Landscapes*

Given the criteria here described, this thesis postulates that buildings are (or should be) *interventions*, that is, they are both (wo)man made cultural *inventions* and natural *interventions* on the landscape. The intent of this work is to understand and demonstrate a positive, sympathetic relationship between nature and architecture, such that there is an comprehensible continuity and exchange between habitation and the environment.
EXAMPLES: Sympathy between (wo)man and nature

A machine gracefully rests with (as opposed to on) the landscape: the human presence does not attempt to dominate or control natural processes.

Traditional Chinese watercolor paintings depict a view of the landscape which includes elements of culture. Consistent with Taoist philosophy, (wo)man and nature exist in seamless unity.
POWERS OF NATURE

Nature alone does/can not magically generate architecture; it is the designer/builder who invents/makes/produces/gives life to a building. Moreover, nature provides constraints and suggestions which can (and I would argue should) influence an agenda towards making buildings.

Needless to say, there are many conditions which directly influence physical built form that are not dictated by nature (e.g. program and economics). But too often, designers neglect the role of natural processes in their design methods, and fail to recognize the impact of buildings on the environment, and the environment's impact on buildings.

What follows is an attempt to elucidate three "scales" or "powers" of nature which are critical in developing a building and design process; at the broadest level, the site, at the intermediate scale, form and formal behaviors, and at the smallest level, material and structure. These three realms are autonomous yet inherently interrelated. By examining them independently, their relationship to one another may become apparent.

In the book Powers of Ten (Philip and Phylis Morrison and the Office of Charles and Ray Eames), "relative sizes of things in the universe" are illustrated in "zoom lens" fashion. The notion of relativity is an important idea to consider: the thing portrayed from far away is not the same as is appears close up.
$P+P$ morison & the office of c. r. eames:

powers of ten: about the relative size of things in the universe
The term "site" suggests that we look at the environment with the intention to act upon it, or to observe an act in it.

J. Habraken: *Transformations of the Site*

Habraken's statement implies that the site is not passive; it contains vital information which leads to human action. A reading of a place helps us to generate some understanding/proposition about architectural organization and form. It is important to recognize that the notion of "site" embodies more than just physical location; it includes features such as climate, topography, context, history, and other attributes which make a place unique and identifiable.

A taxonomy of site traits might be organized about three general categories: physical, phenomenological, and cultural. Physical site properties are those which are concrete and tangible, though not necessarily natural (e.g. terrain and building context). Phenomenological features are natural attributes/actions which (wo)man has no direct control over. Rain, sunshine, earthquakes, and volcano eruptions are all natural phenomena (wo)man cannot harness, and which (can) have a serious effect on the built environment. Cultural properties of the site are those features which (wo)man affects directly. Social history, program, and building technologies are all cultural attributes of a place.

The responsible designer/builder recognizes that the site has the capacity to inform the physicality of the architecture. The qualities of a specific natural or man-made landscape provide specific suggestions towards the definition of a building --its position, its form, its structure, its experience. As physical, phenomenological, and cultural conditions vary with respect to different places/times, one would expect building forms to respond to these variable characteristics.
For instance,

This building in the forest is directly open to the landscape, allowing the outside to move inside (and the inside outside). Like the trees around it, the building is a screen which filters light (and life) through it.

This building in the desert is defensive; it offers protection from the severe conditions (the intense light and heat) of its surroundings. Like the ground it rests on, it is a continuous solid surface which undulates freely.

In both of these examples, the quality of the architecture stems from the specificity of the site. In the desert, the severity of the climate and the sparseness of the land led to a decision to transform the landscape in order to make it habitable. In the temperate forest, the building serves to intensify the landscape, accentuating the qualities of a dense and lively site.
FORMS

"The underlying sense of form in my work has been the system of the Universe, or part thereof. For that is a rather large model to work from."

A. Calder: Calder's Universe

The forms that appear in nature often inspire the forms of inventions. A tree behaves like a column of a building, a bird's wing teaches us how to fly. It is only natural that designers apply the forms of nature; these are the enduring efficient systems which we know well.

The differentiation must be made between plagiarizing natural forms and using natural formal principles. While a biological form might stimulate an idea about some building form/structure, literally mimicking an observed form in nature is not design. Design involves understanding and appropriately transforming natural forms and concepts.

In the work Antoni Gaudi, the predilection towards curved and irregular surfaces and structures reflects the architect's admiration of biological forms and systems. But Gaudi goes beyond using "natural" or "organic" forms as decorative or secondary elements of architecture: they are integral to the building structure. In the Guell Chapel, for instance, nature and building appear to be indivisible. The exterior masonry columns define a place which is like a dense grove of trees; the continuous curved walls suggest primitive cave-like spaces. While this building may have been inspired by the natural landscape, it is boldly original, an autonomous built landscape with sheltering qualities.
Look, it cannot be seen—it is beyond form.

Lac Tsu: Tao Te Ching

In addition to using concrete natural forms as design references, formal behaviors can be used as references. The distinction between form and formal behavior can be described as follows: form is "the shape that makes a content visible." (Amheim, Towards a Psychology of Art, p. 355.) while formal behavior involves the action which a particular form(s) takes (M.K. Smith). Form is a noun, formal behavior suggests a verb. Just as a noun is meaningless without a verb, form is insignificant without action. As Paul Klee writes,

Form is set by the process of giving form which is more important that form itself. Form must on no account ever be considered as something to be got over with, as a result, as an end, but rather as genesis, growth, essence. Form as semblance is an evil and dangerous spectre. What is good is form as movement, as action, as active form. What is bad is form as immobility, as an end, as something that has been tolerated and got rid of. What is good is form-giving. What is bad is form. Form is the end, death. Form-giving is movement, action. Form-giving is life.

P. Klee: Nature of Nature

Thus, the important question designers must ask is not What is the form? but instead, What is the form doing?.

In order to use natural formal behaviors in design, a particular formal concept, organization, or system from the environment is identified and translated into a built context. In this process of abstraction, the perceived qualities of the observed natural artifact may be lost, but what is retained is a direct physical understanding of form.
EXAMPLES OF FORMAL BEHAVIORS

SCREENS
In the forest, the trees screen light, space, and life. The formal behavior involves an alternation of light and dark, space and material. This generic behavior can be easily extrapolated into building.
PARTIAL CONTAINMENTS
A cove by the water serves to protect an area/define a place on the water's edge.
Likewise, we can (and should) use this same generic principle in making partial containments in buildings.
MATERIALS

The planet generously provides us with many materials to build with and from. Materials can be used in their direct raw form (e.g. earth, trees, and rocks) or they can be distilled into more manageable, conventional mediums (wood, concrete, glass).

Tectonics of materials is a misconstrued notion. To suggest that materials are limited in how they can behave severely restricts the possibilities of inventive, useful structures. While certain natural qualities make some materials ideal for specific situations, most materials have the structural capacity to act in a range of ways.

In Jaisalmer, India stone is often used in a way which is conventionally associated with wood: delicately carved sandstone balconies and porches line building edges, stone beams cantilever over walls. An insistent tectonic observer might argue that the material is utilized in an unnatural manner. But one must consider that wood is a scarcity in this environment and stone is the primary building material available. This example illustrates that there is not and should not be a one-to-one relationship between material and structural form.

What is critical in the conversion of material into structure is material authenticity and structural efficiency. Authentic material is material which is identifiable and real; when we touch or see something, we should recognize what it is. The recent emergence of fiberglass bricks made to look like clay bricks is a cultural bastardization. Materials should not pretend to be something that they are not. In the Indian example, the stone is authentic; it is not painted to look like wood.
Structural efficiency means that structure and material are working, not just appearing that they are working. Rowe's Wharf in Boston is a typical contemporary example of structural inefficiency; what appears to be a masonry load bearing arch is in fact a steel frame structure clad in concrete or stone (who can tell?). Recent technology has allowed the opportunity to engineer almost anything. However, it is because of this unlimited technical ability that much current architecture falls short of structural integrity, efficiency, and authenticity.

The difficulty of a hybrid man-made/natural material such as concrete is that its liquid quality allows it to take on any form, surface, or color. Of course, this "difficulty" is often regarded as a luxury which enables the designer to freely control forms and material qualities. In Paolo Soleri's Cosanti and Arcosanti projects, concrete is cast in a variety of ways. One of the most innovative processes is "earthcasting," a method where silt is used as formwork for the concrete. On the global scale, this procedure is environmentally efficient, and on the structural scale, it insures that forms of a man-made material take on natural qualities.
I went to the woods because I wished to live deliberately, to front only the essential facts of life, and see if I could not learn what it had to teach. I went to the woods because I wished to live deliberately, to front only the essential facts of life, and see if I could not learn what it had to teach, and not, when I came to die, discover that I had not lived. I did not wish to live what was not life, living is so dear; nor did I wish to practise resignation, unless it was quite necessary. I wanted to live deep and suck out all the marrow of life, to live so sturdily and Spartan-like as to put to rout all that was not life, to cut a broad swath and shave close, to drive life into a corner, and reduce it to its lowest terms, and, if it proved to be mean, why then to get the whole and genuine meanness of it, and publish its meanness to the world; or if it were sublime, to know it by experience, and be able to give a true account of it in my next excursion.

In my daily life, I have very little involvement with "natural" nature. I live in an adulterated version of nature: the trees I see are planted, the river I walk along is (wo)man-made. Nevertheless, the trees and water are real, the air I breathe is natural, the insects that fly around my head are alive, and the sun that rises to wake me in the morning is authentic.

Inspired by naturalists such as Henry Thoreau, I am using this thesis as an abstract excursion from my man-made environment in attempts to connect myself with nature. (Wo)man and versus nature is a classic dilemma which countless scholars, writers, and artists have discussed for ages and which continues to fascinate and plague architects. It is my opinion that we must respond to the environment directly and compassionately. In traditional Eastern philosophy, (wo)man is generally regarded to be a small part of a large system of nature. While this notion has significance in my mind, these days, it is difficult if not impossible to maintain a humble relationship with the larger world. As Garrett Eckbo writes,

Control of our physical and social environment is one of the chief problems of life for all of us. We want to live in a nice home in a good neighborhood in a stable community in a reliable region in the greatest nation in the world. We want good workplaces, good schools, good centers for shopping, recreation, health care, culture, worship, and services. Yet in spite of these widespread and earnest desires and the greatest prosperity we have ever known, the American physical environment is deteriorating before our eyes, through new mass construction rather than blight and obsolescence, and the social environment is full of strange, violent, and demanding forces.
Regretably, I share Eckbo's cynical view of American society. While I strongly believe that urban and cultural institutions are necessary elements of modern day life, I am disturbed by (wo)man's obsession with controlling the environment rather than coexisting with it. Writer Bill McKibben argues that we have already crossed a devastating threshold of change which he describes as "the end of nature."

By the end of nature I do not mean the end of the world. The rain will still fall and the sun shine, though differently than before. When I say "nature," I mean a certain set of human ideas about the world and our place in it. But the death of those ideas begins with concrete changes in the reality around us—changes that scientists can measure and enumerate. More and more frequently, these changes will clash with our perceptions, until, finally, our sense of nature as eternal and separate is washed away, and we will see all too clearly what we have done.

**B. McKibben: The End of Nature**

As McKibben indicates, commercial and selfish extravagances have seriously hampered the balance of the planet and forever changed our perception of what nature is. The process of destruction is very real: the ozone layer is depleting drastically, the tropical rain forests are dying, we make inefficient decadent buildings which hide ourselves from the world rather than engage it.

While this thesis is not intended to be a sour commentary on contemporary culture, I think that it is important to refer to the damaging effects of (wo)man's irresponsible actions. The hope is that a revived awareness towards the environment/world, as discussed here, may help us to reclaim nature and live healthily in peace. This may seem like narrow-minded trite propaganda, but it is in fact an earnest personal agenda which drives and directs my work.
THE PROJECTS
Two sites, two situations, two buildings.

Why two?

Paul Klee describes why:
A concept is not thinkable without its opposite. The concept stands apart from its opposite. No concept is effective without its opposite.

On contrasting concepts (pairs of concepts):

<table>
<thead>
<tr>
<th>Chaos</th>
<th>Cosmos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disorder</td>
<td>Order</td>
</tr>
</tbody>
</table>

There is no such thing as a concept in itself; generally speaking, there are only pairs of concepts. What does 'above' mean if there is no 'below'? What does 'left' mean if there is no 'right'? What does 'behind' mean if there is no 'in front'?

Every concept has its opposite, more or less in the manner of:

Thesis ———— Antithesis; the line between them is long or short according to the extent of the opposition.

The opposing positions are not fixed; they may slip past one another. Only one point is fixed, the central point in which the concepts lie dormant.

Relatively fixed (in relation to the central point) are opposing points of equal intensity.

Paul Klee: The Thinking Eye p. 15
left west this desert

You can't understand one
right
east
that

ocean

without the other

(What follows is a design chronology which traces the process of exploring, thinking, and building on two different-polar sites)
Arcosanti, located in the high desert approximately seventy miles north of Phoenix, is the construction site for a small town of 5000 people. Arcosanti intends to become an Urban Laboratory where on a modest scale we will test urban design principles and the fundamental tenets of arcology.

**ARCOLOGY**, a combination of two words, architecture and ecology, points at the interdependence of the two: The human abode within the planetary abode.

**ARCOLOGY** addresses itself to the resources in the environment and to the evolution of the human spirit. **ARCOLOGY** is a methodology that recognizes the necessity for radical reorganization of the sprawling urban landscape into dense, integrated, three-dimensional towns and cities. Arcosanti offers an alternative to current urban dilemmas and at the same time seeks to re-establish contact between people and an undisturbed landscape. A major tenet of **ARCOLOGY** is that the city is a necessary instrument for the evolution of the human spirit (civilization).
Only 14 miles from downtown Boston, it is, indeed, as Samuel Wakeman declared in his original letter as Chairman of the Committee to Preserve World's End, "an island of beauty where we can still enjoy the satisfaction of lying in a field of warm grass and looking at the sky; where we can still watch wildlife undisturbed by the noise and confusion of the city; where we can still walk on beaches washed by the sea without seawalls and hot dog concessions, and where we can turn momentarily to simple pleasures such as seeing a child explore the mysteries of the coming spring."

Gordon Abbott, Jr.
Director, The Trustees of Reservations
February, 1973
The sky

(Avecosanti)
The Water

(World's End)
The horizontality of the ground (Arcosanti)
The vertical screens of trees

(World's End)
Perceiving infinite distances...

(Arcosanti)
Depth is foreshortened by layers of life.

(World's End)
Arcosanti: conceptual drawing
World's End: conceptual drawing
Arcosanti: Projective Conceptual Sketch
World's End: Projective: Conceptual Sketch
The approach to Arcosanti is not promising, a long drive north up I-17 through spectacularly rugged desert country beginning to turn toward sagebrush as one comes up to the turnoff point at Cordes Junction—a nowhere place if there ever was one: some trailer homes, a filling station, a bar and precious little else but a dirt road leading off into, apparently, nothing. That road, followed for a couple of miles, eventually leads to a parking lot by a usually not very busy building site, a few disconnected structures ranged along the side of a small canyon that deepens away into the distance, and finally opens into a broad plain a mile or more away.

The seemingly scattered buildings do, in fact, join up into a designed sequence, are joined up chiefly by cunning landscaping that makes a simple gardening of grass and trees between one fragment and the next. The fragments in themselves are magnificent—huge echoing vaults and apses looking out across the canyon, the vaults painted in strong, earthy ceramic colors, the apses gently fluted on their inner faces; with steps going processionally over the outsides of the vaults and little habitable cubicles tucked in neatly and symmetrically all around.

It has been described as "telescoping the environmental experiences of the Baths of Caracalla and Club Mediterrañée" and if that was meant to be unkind, there is more than a grain of truth in it, because the general effect really is very like camping out in grand style in a great Roman ruin or the abandoned film set for an old-time movie spectacular.

Reynier Banham: scenes in america deserta
In any case, World's End is surrounded by water except on the south. It is, however, shielded from the open sea by the hills and connecting gravel reefs of Hull; and from the hills of World's End, particularly from the highest of these, Planter's Hill, there are spectacular views in every direction: northward to Graves Light and the North Shore, northeasterly over the Weir River and Nantasket to the Atlantic, southeasterly to the Turkey Hills and Whitney Woods, southwesterly over Hingham Harbor and its islands, westerly to the Blue Hills of Milton, and northwesterly to Bumkin Island and the Boston skyline.

World's End consists of some 248 acres and over five miles of shoreline. There are four hills, running roughly north and south, an area of cliffs and ledges, known as “Rocky Neck”, running eastward from Planter's Hill, a large meadow lying south of Rocky Neck and Planter's Hill, and a strip of woods, ledges and ravines separating this meadow from Cedar Gables. This strip of woods was, in pre-colonial times, separated from the rest of World's End by salt water at high tide. The seventeenth century settlers built two dams, however, one at the Weir River end and one at the Martin's Cove end of the meadow, which connected Rocky Neck and Pine Hill to the mainland and also served to reclaim the “Damde Meddowes”, as they were thenceforth called, from the sea. Another causeway, “the bar”, was built, perhaps at about the same time, from the north end of Planter's Hill to the two northernmost hills, thus connecting them also to the mainland even at high tide. Still other causeways were built east of what is now Porter’s Cove Road connecting a small island in Porter’s Cove to Cushing’s Neck at two points and reclaiming from the sea the intervening area, another Damde Meddowe, known to more recent generations as the “East Meadow”. World's End, then, consists almost entirely of two islands connected to each other and to the mainland artificially by the efforts of the Puritan Fathers, just as, further north and east, the six hills of Hull were connected to each other and to the mainland by natural causes, erosion and wave action, in a far earlier time. At any rate, the hills and shores of World's End have delighted many generations of visitors who have come by foot or on horseback or in small boats, and thousands more who have inspected World's End from yachts and from the commercial boats which have plied between Boston and Nantasket since the last century.

a history of world's end p. 1
THE SKY (Arcosanti)

During the summer at Arcosanti, we lived like vampires, our rituals controlled by the light of the sky. We rose at dawn, beginning our work early when the sun was low and the air was crisp. As the day progressed, the burning heat and bright light became bothersome and we sought protection indoors or under hats and light shelters. Daylight was the time to focus on our work, and for many of that meant working directly with or on the ground, pouring concrete, shoveling silt, piling rocks. But as the sun went down and darkness encroached, our attention moved up towards the sky. We would lie on the roofs of the buildings to graciously greet the moon. There were nights we would stare at the sky for many hours, sometimes all night, discovering galactic constellations, searching for shooting stars, satellites, and planes. At night, we were enchanted by the vastness of the open sky.
THE EDGE (World's End)

Once on the water's edge, I jump from one rock to the next. It's like a game of hopscotch: I move forward, backward, sideways. I don't know where I'm going, but I'm going there. Each rock is different in character. There are "Pollock rocks" featuring colorful drips and fractures. There are "elephants" with wrinkly surfaces. Then there are "eggs", slippery, smooth, and clean. I pause to sit on a "chair" (a terracing flat rock); on one side of me I feel protected as I look up at the tall leafy trees, but on the other side, I am vulnerable as I watch and listen to the water gushing towards me. I forget that I am so close to the city.
In February I had an identity crisis.
TO: Shun Kanda, Frank Miller
FROM: Julie Chang
RE: thesis FEB 27 1992

The original idea for this thesis came from wondering why buildings are different in different places. Initially, I proposed that the site directly informs architectural form, and that building decisions are phenomenologically linked to the landscape.

Later (now), I realize that the site is only one of a large array of constraints which can influence design. In the current draft of my thesis, I have categorized two types of design constraints: natural and cultural. Natural constraints are those which (wo)man has no direct control over, e.g. climate, terrain, flora. Cultural constraints are limits which (wo)man imposes on him/her-self, e.g. program, technology. Designing buildings involves developing applications which satisfy both of these orders.

I am not prescribing a purely scientific, linear, empirical approach towards my work. Intuition and serendipity are personal components of experimentation which I recognize as being crucial in the processes of thinking and designing. Nevertheless, without clear limitations and agendas, design cannot happen.

Throughout my architectural education, constraints were predetermined. My role as a student was not to develop a firm architectural position, but to apply a position which was imposed or suggested. In my final months as a student, I realize that I now must learn to establish my own agenda and not gullibly succumb to one which has been fed to me. As a newly "born again" architect, I want to design with a fresh mind and attitude. While I cannot and do not want to deny the baggage I have collected over the years, I do want to begin to formulate an agenda which is my own in order that I can do what I do with conviction and confidence.
ARCOSANTI SILT PAVILION

• Workshoppers come to Arcosanti to learn innovative construction and craft techniques developed and demonstrated by Paolo Soleri. The Arcosanti Silt Pavilion is a place where residents and visitors of Arcosanti can experiment in silt casting concrete and plaster pieces. In addition, facilities should include a small studio for a resident artist/sculptor.

• The location for the pavilion will be on the flat area just below the Music Center (where a temporary tent currently rests).

• The proposal must offer protection from wind and rain but at the same time include areas open to light (to facilitate quick drying of cast pieces).

• During special occasions, slide/light/shadow shows are projected on the onlooking mesa. The design should accommodate these situations.

• Should be easily accessible from the primary path system of the complex (current access is difficult).

• Water is precious: a system should be devised to save rain water so it can be used directly in the casting process (mixing concrete and plaster, diluting silt).

• The preferred, most feasible construction method for the site is poured in place concrete. Silt from the nearby river bed can be used as formwork.

FEB 27 1992
WORLD'S END CANOEING PAVILION

- The facilities (will) include: a pier and landings for rental canoes, an area for canoe storage, an office for a permanent staff person, some sheltered exhibition space, restrooms, an outdoor area for picnicking.
- The location of the project is on Rocky Neck, a small protected cove by the water which includes habitable terracing rocks and oversees Olmstead's Planter's Hill.
- To preserve the quality of the place, no cars are allowed into Rocky Neck (visitors are encouraged to arrive by boat, or to park in a nearby lot). The current path system will be further developed to allow for easy pedestrian access into the site.
- Materials of the site (trees, granite) should be used. The building method should involve an assemblage of elements: posts, sticks, blocks, etc. which are in or are easily brought into the site. Rocks may be redeployed on the landscape.

FEB 27 1992
The Silt Casting site. Main access level is ~+16 feet.
The canoeing site. Pines, maples, oaks, rocks, water.
Arcosanti: View from inside the existing pavilion
World's End: View from the site
Silt casting at Arcosanti
canoeing...

Old Town Discovery Canoes

New Discovery Sport Boat

L.L.Bean
NORTH AMERICAN CANOE SYMPOSIUM
JUNE 5-7, 1992

Our best canoes for family recreation, general touring and canoeing on calm water. Perfect for any canoeist who enjoys the solitude and tranquility of a paddle down the river or the fun of kayaking. Each canoe features a high-back seat that can be removed for comfortable paddling. Roomy enough for two or three people. Tough shell and easy to carry. Easy to launch and maneuver. Lightweight and easy to store. Effective entry and exit slots. Comfortable backrest. Excellent for family use. Available in 10', 12', 14', 16' and 18' lengths.

OLD TOWN DISCOVERY CANOE

Model 100

Model 140

Model 160

Model 180

Model 200

Model 220

Model 240

Model 260

Model 280

Model 300

Model 320

Model 340

Model 360

Model 380

Model 400

Model 420

Model 440

Model 460

Model 480

Model 500

Model 520

Model 540

Model 560

Model 580

Model 600

Model 620

Model 640

Model 660

Model 680

Model 700

Model 720

Model 740

Model 760

Model 780

Model 800

Model 820

Model 840

Model 860

Model 880

Model 900

Model 920

Model 940

Model 960

Model 980

Model 1000

Model 1020

Model 1040

Model 1060

Model 1080

Model 1100

Model 1120

Model 1140

Model 1160

Model 1180

Model 1200

Model 1220

Model 1240

Model 1260

Model 1280

Model 1300

Model 1320

Model 1340

Model 1360

Model 1380

Model 1400

Model 1420

Model 1440

Model 1460

Model 1480

Model 1500

Model 1520

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Model 1600

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Model 1960

Model 1980

Model 2000

Model 2020

Model 2040

Model 2060

Model 2080

Model 2100

Model 2120

Model 2140

Model 2160

Model 2180

Model 2200

Model 2220

Model 2240

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Model 2280

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Model 3800

Model 3820

Model 3840

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Model 3880

Model 3900

Model 3920

Model 3940

Model 3960

Model 3980

Model 4000
Arcosanti Geology model: the ground is composed of hexagonal columns of basalt which have eroded over time.
Geography is life's limiting factor. Speciation—life itself—is ultimately a matter of warm and cool currents, rich and bare soils, deserts and forests, fresh and salt waters, deltas and jungles and plains. Species arise in isolation. A plaster cast is as intricate as its mold; life is a gloss on geography. And if you dig your fists into the earth and crumble geography, you strike geology. Climate is the wind of the mineral earth's rondeur, tilt, and orbit modified by local geological conditions. The Pacific Ocean, the Negev Desert, and the rain forest in Brazil are local geological conditions. So are the slow carp pools and splashing trout riffles of any backyard creek. It is all, God help us, a matter of rocks.

Annie Dillard: Teaching a Stone to Talk
World's End: some ideas about roofs, storing boats, the ground
ARCOSANTI: sloping a habitable roof in order to collect water.
ARCOSANTI: Introducing water inside the building
Scribbles from a desk crit with Maurice Smith
Silt casting exercises.
At right: surface details.
ARCOSANTI: cisterns and canals
Kupka: Disks of Newton-Study for Fugue

Park Güell

"Serpentine behavior" references
coney island boardwalk

pier references

beals island, maine
WORLD'S END MONTAGE: framing views, building an exchange between elements.
WORLD'S END: containments and "rocks" within a system of screens
CONTENT REVIEW: Fernando Daneyko, Maurice Smith
ARCOSANTI: SECTION MODEL
WORLD'S END: SECTION MODEL
What is it made of, this pleasure?—Principally of this: the pine woods is a piece of nature, made of trees all of a clearly defined species; a well delimited piece, generally quite deserted, where one finds shelter from the sun, from wind, from visibility; but no absolute shelter, nor one completely isolated. No! It is a relative shelter. Not a sneaky shelter, nor a measly one, but a noble shelter.

It's a place too (this is particular to pine woods) where development is gradual, natural, without coppicing, without man-high branches, where sprawling out simply occurs, without slackness, but quite comfortably.

F. Range: "Notebook of the Pine Woods"
It shapes itself, grows up and thickens incessantly in much the same way in numerous parts of the world, with structures more or less vast whose model I’m going to try to describe:

They are composed of a ground-floor with a very high ceiling (though this last term may be incorrect), and above that an infinity of floors, or rather an extremely complicated framework that constitutes the upper storeys, ceiling and roofing.

No more walls than roof properly speaking: they are rather more like a hall or a courtyard.

An infinity of columns support this absence of roofing.

F. Ponc: "Notebook of the Pine Woods"
WORLD'S END: SITE MODEL
ARCOSANTI: Rethinking the Structure -- instead of a single cast-in-place roof, an assemblage of precast elements
ARCOSANTI: Revised building system
The notion of discovering an underlying order in matter is man's basic concept for exploring nature. The architecture of things reveals a structure below the surface, a hidden grain which, when it is laid bare, makes it possible to take natural formations apart and assemble them in new arrangements. For me this is the step in the ascent of man at which theoretical science begins. And it is as native to the way man conceives his own communities as it is to his conception of nature.

J. Bronowski: The Ascent of Man
Landscape #1: The Desert
Landscape #2: The Edge
Landscape #1: The Desert
Landscape #2: The Edge
REFLECTION
SOME NOTES ON PROCESS AND DIAGRAMMING

*Do you feel that nature has any serious relation to your own work?*
“Everything is natural. If you can imagine it, you can make it. . . .”
*If so, is it a conscious or a predominantly subconscious one on your part?*
“I just don’t think about it.”

*Presuming that you as an abstract artist are drawn to nature by certain eternal qualities or forces sensed there, would you say that your work is a predominantly subjective expression of your personal relation to these qualities and forces?*
“I just do the best I can.”

*A. Calder: Calder’s Universe*

The two design projects of this thesis (were to) demonstrate how architecture could react directly to ecological issues. The hope was (and is) that a conscious agenda towards nature would lead one (me) to develop architectural forms, systems, and structures which satisfied defined constraints. But while the agenda of this thesis is explicit and premeditated, the design process which ultimately resulted from it is not.

In assessing and criticizing the designs of others, one must respect the criteria of the designer and the constraints (s)he faced. "Artistic license" is an unjustifiable defense of architectural design. Designers, particularly architects, must be able to explain the decisions that they make, even if they were the outcome of random outbursts of intuition. The distinction between architecture and art is that architecture must go beyond satisfying personal criteria. Architecture, by (my) definition, must fulfill needs which are often supplied by an external source. Unlike art, building is dependent on constraints which the architect/artist cannot directly control.
My education at MIT has convinced me that process is more crucial than product, that a lucid understanding of how one works and makes decisions is ultimately more valuable and enduring than any highly refined design. At the outset of this thesis, I wanted to believe that my design decisions were not personal acts, and had some relationship with the natural environment. Now, as I attempt to close this thesis and my education, I believe it is important to make sense of my design process, to depersonalize my work such that I am able to appropriately defend and transform the decisions put forth.

What follows in this section is an effort to come to terms with the development of the two building designs, to understand how a prescribed agenda led to specific decisions about site positioning, building form, and material construction. Hopefully, it is possible to extract some generic understandings concerning building and propose some design criteria which may be applied to other work. The method to do this will be through a series of diagrams which attempt to abstract information about the two sites and buildings designs. When diagraming, one must consciously editorialize what is observed or perceived, and in this process, obvious and esoteric concepts may be discovered. Through a diagram, perhaps clarity can be retrieved from chaos. As Gertrude Stein writes,

> You make a diagram or a discovery, which is to discover by a coincidence. Oh yes a diagram I say a diagram to discover by coincidence, that's not what a diagram is but let it be. I say let it be. You make a discovery, it is a coincidence, of course yes a coincidence, not an accent but an access, yes a coincidence which tells you yes. Yes it makes it possible to make the discovery. And after that, yes after that, a great deal that has perplexed you about sound in connection with sense is suddenly clear.

> G. Stein: *Four in America*
ABSTRACTING THE SITE

In the middle of the desert. On the edge of the ocean. The geological and geographical differences seem obvious. By studying specific physical attributes of the two sites, it is possible to perceive how the natural features of these places contribute to the resulting cultural layers.

The adjoining drawings isolate topographical and cultural site attributes. The diagrams suggest that in Arcosanti, there is a sparseness of physical definition; systems of roads tend to be independent of topography. In World's End, the intensity of the topography and natural features directly inform the (wo)man made street systems.
UNDERSTANDING PLACES

Moving from the power of the larger site to that of the immediate site, the topography continues to prevail. But as we zoom down in scale, we move from the general landscape to the particular landscape. *Places* become defined.

In both Arcosanti and World's End, the directionality of the contours is clear. Independent elements such as buildings and trees tend to reinforce the behavior of the natural topography.
ARCOSANTI

CONTOURS

WORLD'S END

ELEMENTS REINFORCING TOPOGRAPHY
One of the features which distinguishes these two sites is the manner in which contained places are defined: at Arcosanti, containment is defined in section, between ground and sky, at World's End, containments are defined in plan between water, rocks, and trees. Because of the sparseness of physical elements, one perceives the desert as a cosmic place. The rich natural definition on the wooded cove leads to the perception of a picturesque, idyllic landscape.
WORLD'S END

PARTIAL CONTAINMENT/EXCHANGE in PLAN
DIAGRAMING BUILDING CONCEPTS

In addition to being influenced by the external natural forces of the site, buildings have an internal logic of space, light, and structure which can exist independently from its surroundings. After all, architecture does not effortlessly emerge from clues on the site, it is contrived or invented by carefully negotiating natural and cultural constraints. The tension between the inventive-interventive qualities of building is rooted in the always debatable relationship between (wo)man and the environment.

Many ideas for the design projections of this thesis were drawn from analyses of several buildings in different landscapes and cultures. Through diagrams and explicit recognitions, it is possible to understand how specific buildings exhibit generic behaviors which can be applied to one's own design process. To appreciate the work of another architect is not enough; one must be able to explain why (s)he finds the work laudable. The attitude taken here is that transferring the concepts found in references to one's own work is not an act of immoral plagiarism, but a way of clarifying building behaviors, and exposing broader generalities of design.
I shall begin with a brief clarification of concepts. First, the meaning of analysis. The term is most frequently applied to chemical analysis. A certain compound, for example, is widely sold because of its excellent effects. The manufacturer's commercial success arouses the curiosity of other manufacturers and they send a sample of the product to a chemist for analysis. He must proceed methodically in order to break the product into its ingredients. To solve the riddle.

In another case a food or beverage is harmful to the health. Again the chemist is called in to disclose the harmful ingredients. In both cases the given is a whole consisting of various unknown parts; the problem is to find the ingredients.

In our business the motives for analysis are naturally different. We do not undertake analyses of works because we want to copy them or because we suspect them. We investigate the methods by which another has created his work, in order to set ourselves in motion. This approach should save us from regarding a work of art as something rigid, something fixed and unchanging. Exercises of this kind will guard us against creeping up to a finished product hoping to pick off what is most striking, and to make off with it.

One particular kind of analysis is the examination of a work with a view to the stages of its coming-into-being. This kind I call the analysis of ‘genesis’. The first book of Moses, concerned with the creation of the world, is called Genesis. It tells what God created on the first day, on the second day, etc. The total world that surrounds us is articulated in terms of history.

We are artists, practical craftsmen, and it is only natural that in this discussion we should give priority to matters of form. But we should not forget that before the formal beginning, or to put it more simply, before the first line is drawn, there lies a whole prehistory: not only man’s longing, his desire to express himself, his outward need, but also a general state of mind (whose direction we call philosophy), which drives him from inside to manifest his spirit in one place or another.

I emphasise this point to avoid the misconception that a work consists only of form. But what must be stressed even more at this point is that the most exact scientific knowledge of nature, of plants, animals, the earth and its history, or of the stars, is of no use to us unless we have acquired the necessary equipment for representing it; that the most penetrating understanding of the way these things work together in the universe is useless to us unless we are equipped with the appropriate forms; that the profoundest mind, the most beautiful soul, are of no use to us unless we have the corresponding forms to hand.

paul klee: the thinking eye p.99
FALLINGWATER
Frank Lloyd Wright
Bear Run, Pennsylvania
1935-7

The Fallingwater house is one of the finest examples which comes to mind of a building which demonstrates a direct and convincing continuity between architecture and landscape.

This continuity is built by:

- Applying behaviors and systems found in the immediate landscape to the building.
- Utilizing natural materials (rocks) from the site in a direct way.
- Building a formal exchange between inside and outside in the building's plan and section.
- Reinforcing the directionality of the site.
- Using recurrent spatial dimensions.
Photos from 1992 Fallingwater Calendar. Abbeville Press.
(C. Little, photographer)
FALLINGWATER

GENERIC DIAGRAM SEQUENCE:  EXCHANGE BETWEEN TWO TERRITORIES

2 territories: NO EXCHANGE
lateral displacement
double lateral displacement: PARTIAL CONTAINMENT and EXCHANGE defined
extended lateral displacement: RECIPROCAL EXCHANGE between 2 territories
RECI PRO CAL EXCHANGE in SECTION between landscape and building
DIRECTIONALITY of the landscape (the river, the road, the contours) is reinforced by the building access system. Most of the stairs and entries in the house are oriented in the direction of the site; access and directionality are further intensified by masonry walls.
DIMENSIONS inside of the building recur as spatial landscapes outside of the building.
THE CHAPEL OF RONCHAMP
Le Corbusier
1950-3

Ronchamp's presence on the landscape is undeniably domineering: it is on top of a barren hillside and its plastic spaceship form screams for attention. However, despite its unusual form and object-like existence, the siting and behavior of the architectural elements are extremely sensitive to the particularities of the landscape.
RONCHAMP

The curved outdoor wall/platform serves to contain the building in an open, exposed landscape.

DIMENSIONAL STABILITY: dimensions of the building recur as dimensions of the landscape.
EXCHANGE between ground and sky in SECTION.

DIMENSIONS IN SECTION are related to DIMENSIONS IN PLAN.
PARTIAL CONTAINMENTS defined in plan.
ENTRANCES and OPENINGS

Entry into the public space marked by change in direction.

Opening built between two partial containments.

Entry defined by a partial containment displaced from continuous edge.
 Several buildings were studied which used systems of screens and walls. Screens of columns are often designate areas open to access; walls are generally used to define places intended to be contained. There are many variations of these two systems: screens can be built inside and in between contained areas (Gaudi's Guell Chapel) or containments may be deployed inside a system of screens (Atelier Zo's Nakijin Community Center). Note that the behavior of screens and surfaces is not dependent on material. Screens could be built from sticks of wood or pieces of stone (Gaudi); walls could be made from heavy masonry or light steel.
Atelier 20: Nakijin Community Center
DIAGRAMING THE DESIGNS

The proceeding diagrams attempt to evaluate and clarify the content of the two design projects. While the analysis of other buildings consciously and unconsciously influenced decisions I made, it is not my desire to compare my design with the references I have studied. Such a comparison would be demoralizing and unnecessary. Admittedly, certain behaviors and features of my work may be directly associated with that of other architects. However, the general intention is not to blindly mimic and praise the buildings I see and study, but to critically assess designs which are not my own and confidently apply them to my own work.
SERPENTINE behavior of ramp and building PARTIALLY CONTAIN a piece of the landscape.
CONTINUOUS SURFACE SCREENS.

EXCHANGE in section.
WORLD'S END CANOEING PAVILION

BUILT EXCHANGE with the landscape in plan.
BUILT EXCHANGE with the landscape in section.
ASSESSING THE METHOD

The architectural design process might be dissected into four essential component actions: conceptualizing, formalizing, systematizing, and synthesis.

1. CONCEPTUALIZING
   Establishing some clear set of intentions regarding the project and site.

2. FORMALIZING
   Developing specific architectural forms and formal behaviors. Includes not only an understanding of what is physically built, but the space being built, in terms of access, light, etc.

3. SYSTEMATIZING
   Determining how the building will be made in terms of systems of structure, closure, mechanical, etc.

4. SYNTHESIS
   Finally, concept, form, and systems must assimilate into architecture.

While all of these ingredients are necessary to design, the ordering of them is not necessarily hierarchical. An effective exploratory design method is not completely predetermined and rationalized: there must be room for the designer to make changes, question decisions, and "play." It is not a blind, arbitrary process, but a deliberately variable one.
Charles Olson, in his essay, "Projective Verse," writes exactly of such a working method:

Now (3) the process of the thing, how the principle can be
made so to shape the energies that the form is accomplished.
And I think it can be boiled down to one statement (first
pounded into my head by Edward Dahlberg): ONE PERCEPTION
MUST IMMEDIATELY AND DIRECTLY LEAD TO A FURTHER PERCEPTION. It means exactly what it
says, is a matter of, at all points (even, I should say, of our man-
agement of daily reality as of the daily work) get on with it,
keep moving, keep in, speed, the nerves, their speed, the per-
ceptions, theirs, the acts, the split second acts, the whole busi-
ness, keep it moving as fast as you can, citizen. And if you also
set up as a poet, USE USE USE the process at all points, in
any given poem always, always one perception must must must
MOVE, INSTANTER, ON ANOTHER!

C. Olson: Selected Writings

The point is this: design is an open-ended process of thinking, doing, and
most importantly, learning.

A young man in Japan arranged his circumstances so that he was able to travel to a distant island to
study Zen with a certain Master for a three-year period. At the end of the three years, feeling no sense of
accomplishment, he presented himself to the Master and announced his departure. The Master said, "You've
been here three years. Why don't you stay three months more?" The student agreed, but at the end of the
three months he still felt that he had made no advance. When he told the Master again that he was leaving,
the Master said, "Look now, you've been here three years and three months. Stay three weeks longer." The
student did, but with no success. When he told the Master that absolutely nothing had happened, the Master
said, "You've been here three years, three months, and three weeks. Stay three more days, and if, at the
end of that time, you have not attained enlightenment, commit suicide." Towards the end of the second
day, the student was enlightened.

J. Cage: Silence
SOME NON-FINAL NOTES

Everybody gets so much information all day long that they lose their common sense. They listen so much that they forget to be natural. This is a nice story.

Gertrude Stein: "Reflection on the Atomic Bomb"

This thesis has attempted to investigate a number of independent but overlapping issues: the role of nature in design, duality, cross-cultural/cross-natural design attitudes, and the conscious understanding of one's design process. As I try to make sense of this work, I am reluctant to formulate premature conclusions. At this writing, it is difficult to assess the consequences of what I have done because the process and synthesis of working and thinking continue to be active.

Nevertheless, here are some non-final notes:

- This study knowingly overlooks important cultural aspects of the two chosen sites. Most notably, there has been no elaboration on the theories and projections of Paolo Soleri in Arcosanti and Frederick Olmstead in World's End. In Arcosanti, Soleri plans to build a high density urban community; Olmstead's goal at World's End was to develop and parcel the landscape for individual houses. These are polar positions towards the environment: one attitude involves the concentration of human activity in the land so as to minimize interference with nature, the other position proposes to spread cultural presence throughout landscape. To extrapolate on these issues would have been (and could be) another thesis. However, this exploration is limited to the order of a single building or intervention within a predominantly natural setting. In theory, one should be able to use the concepts learned from this work in order to study architecture at the size of the settlement or community.
Paolo Soleri's vision for Arcosanti

Clmstead's plan for World's End
While the physical and metaphysical differences between the desert and the ocean cove are describable, how these differences suggest different buildings is less clear. Why does a continuous surface concrete dome seem appropriate in the desert but not on the water's edge? Why is a wooden screen building a sensible solution in one landscape but not another? Our preconceptions regarding how and what to build on a particular site is often directly informed by local technology, traditions, and materials. For instance, there are very few buildings in the desert made of wood because quite simply, there are no (or very few) trees in the landscape. While designers are often persuaded to respect "regional" standards, these recognized norms are by no means absolute. Yes, a building should respond to the particularities of a place, but it must also transcend "context" and "regionalism" in order that it may be understood autonomously.

The interest of working simultaneously on two sites is not only to elaborate on their similarities and differences, but to effectively have the two affect one another. Though we may understand the desert to be the opposite of the ocean, we can bring something which is discovered from the desert into the ocean. Designers can and should not be confined to singular, minimal understandings of places and cultures; often times, the most compelling architecture is generated by translating an understanding from one culture and place to another. An example of such a cross-cultural, cross-regional architecture is the work of Tadao Ando. In Japan, there has been a long, treasured tradition of post and beam screen structures. Within this strong building culture, Ando has introduced concrete continuous surface building techniques familiar in European modern architecture. Despite using a foreign building technology, Ando is still able to retain rich qualities in his work which are often associated with Japanese traditional architecture, most notably, the careful articulation of light and darkness.
• The original ideas for this thesis stem from an admiration of the natural landscape and personal experiences in both the Northeast and Southwest regions of the United States. The two chosen sites share a strong quality: they are places dominated by the presence of nature, where cultural influences have been sensitive and subtle. The tendency in the modern age has been to live in large artificial settlements packed with materialistic amenities; this style of living has led us to disregard nature in our lives. One of the reasons for choosing to do a thesis which deals with the landscape is to propose that the natural landscape should be an integral, not exceptional, part of our everyday lives.

• There is no question that the ecological balance of the environment is in severe danger. I believe that in order to survive on this planet, we must not only learn to appreciate the landscape, but we must work to inhabit it responsibly.

The problem is that nature, the independent force that has surrounded us since our earliest days, cannot support our numbers and our habits. We may well be able to create a world that can support our numbers and our habits, but it will be an artificial world, a space station. Or just possibly, we could change our habits.

B. McKibben: The End of Nature

In other words, we need to realistically redefine our position in nature.

Our perception of nature is relative to the quality of mind or attention that serves as our instrument of cognition. We see only things, entities, events; we do not directly experience the forces and laws that govern nature and the cosmos.

J. Needleman: Introduction, Tao Te Ching
The premise of this thesis has been that design is a process of exploration rather than problem solving. The complex journey of discovery in design never ends, it only stops. It is through this work that I have realized that architecture is not a discipline of rules and predetermined ideas, it is a pursuit which relies on experience, knowledge, intense observation, and patience.

One last reference:

We shall not cease from exploration
And at the end of all our exploring
Will be to arrive where we started
And know the place for the first time.
Through the unknown remembered gate
When the last of earth left to discover
is that which was the beginning.

T.S. Eliot: "Little Gidding," Four Quartets

So finally, here this thesis stops but does not end.
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ILLUSTRATIONS SOURCES


p. 21 (left) Elliot Porter. Summer Island.


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