Eco-Technologies:
A Collaboration with Nature

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Ironically, the creative act of designing and constructing a building is often preceded by a violent act of destruction: the scraping of the earth, the displacement of wildlife, the use of non-renewable resources and the manipulation of the natural landscape. In contrast, Ian McHarg writes in his book *Design with Nature* that humanity's "life, in sickness and in health, is bound up with the forces of nature, and that nature, far from being opposed and conquered, must rather be treated as an ally and friend, whose ways must be understood, and whose counsel must be respected...."

The largest impact on the natural environment and landscape comes from the built environment. Buildings consume the greatest amount of resources and materials, create the greatest amount of waste, and claim the greatest amount of natural landscape. If we can design our buildings as environments that harmonize with the natural surroundings and land, we can derive principles from such designs that simultaneously increase our understanding of our relationship with nature and our dependency on the natural environment for our own well-being. As McHarg and the first law of ecology suggest, everything is related to everything else. The study of ecology is the study of connectedness. As Theodore Roszak points out in the edited book *Ecopsychology*:

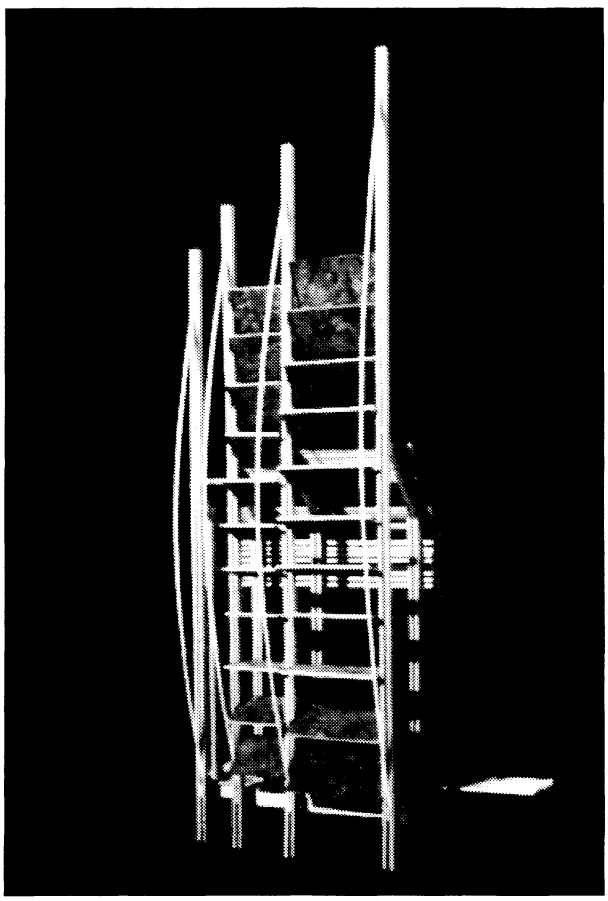
> *It began its intellectual history as the holistic study of the myriad niches and crannies in which life has taken hold on this planet, but its destiny was to be much greater. It has eventually come to see the entire Earth as a remarkable cosmic "niche intricately connected with the grand hierarchy of systems we call the universe." As nature around us unfolds to reveal level upon level of structured complexity, we are coming to see that we inhabit a densely connected ecological universe where nothing is "nothing but" a simple, disconnected, or isolated thing. Nor is anything accidental.*

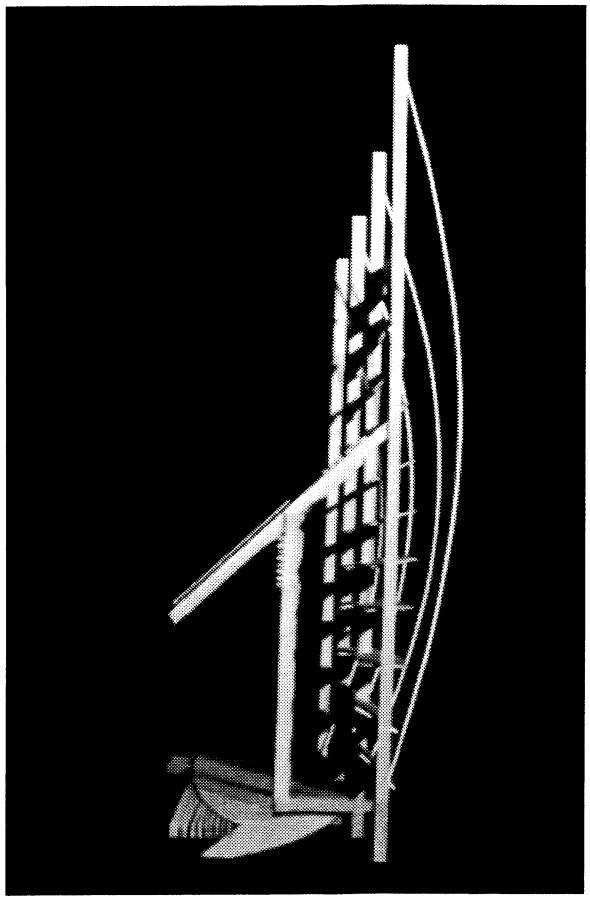
This theory was the starting point in developing my seminar course called *Building in the Land.*

The inspiration for the course came from the need to develop in students an understanding of the interrelationship and impact of their actions as designers. Using as a basis ancient traditions of contemplative practice, the course was developed to foster contemplation of the relation between the built and natural environment in a way that may, in turn, enable us to reconsider and change how we design and construct our built environment. The primary questions raised to begin the discussion in the course were:

- What is our relationship to the natural environment?
- What is the impact of the built environment on the natural environment and landscape?
- How can the forces of nature be used to shape and inform the design of the built environment?

To explore the answers to these questions the following three perspectives were developed throughout the course:





Figs A (previous page) + B (above): Terra Archetype—The concept proposes using the Earth that has been removed from the site to create panels in the facade that combine passive solar gain and shading. The panels have been placed at different angles according to the angle of the sun year round allowing sunlight to penetrate the space in the winter and developing shading from summer sun.

- *Within the structure*—an internal, personal contemplative awareness that focuses on balancing the mental, spiritual, social and physical elements of the being through spatial experiences that connect to the built and natural environments.
- *Outside the structure*—an external holistic experience that reconnects the aesthetics and impact of the structure to the context, land, nature and the environment.
- *The interface*—creating transitional spaces between the two—inside and outside— separating, blurring and reconnecting the inside to the outside environment.

The course was both experimental in nature as well as numerical. It was about a way of contemplating, thinking and weaving ecological ideas with other influences that can be developed into future design projects. The key to the explorations was to balance the poetic and technical aspects of each project. The course was developed as a technology credit with the focus on ultimately designing buildings as low impact physical interventions.

The primary objectives of the course included:

- Developing ideas pertaining to the symbiotic relationship between humanity, nature and technology
- Introducing and develop design principles that incorporate the basic elements of sun, wind, earth and water using both passive and active technologies
- Analyzing projects that exhibit constructive partnerships between ecology and building
- Raising questions about building technology, ecological thinking and aesthetic implications

Criteria that needed to be understood at the completion of the course included:

- Environmental conservation
- Understanding the architects' responsibilities with respect to environmental and resource conservation in design
- Understanding the basic principles that inform the design of building envelope systems
- Ability to assess, select and integrate systems in building designs
- Ability to employ basic methods of data collection and analysis to inform all aspects of the design process

Projects and exercises were developed that explored technology, architecture and nature. The projects included:

Precedent Studies

The concept portion focused on precedent studies and research of other places and cultures that used as resources the sun, wind, earth and water. Researching both historic and contemporary examples students used the elements as resources to develop an understanding of how concepts and forms were developed in the built environment. Each precedent defined a design problem and analyzed the building forms as solutions.

Archetypes

As a means of synthesizing the knowledge, students were asked to develop a physical model of the skin (wall, roof, foundation) as an interface between the private interior experience and transitions to the external social and natural environment.

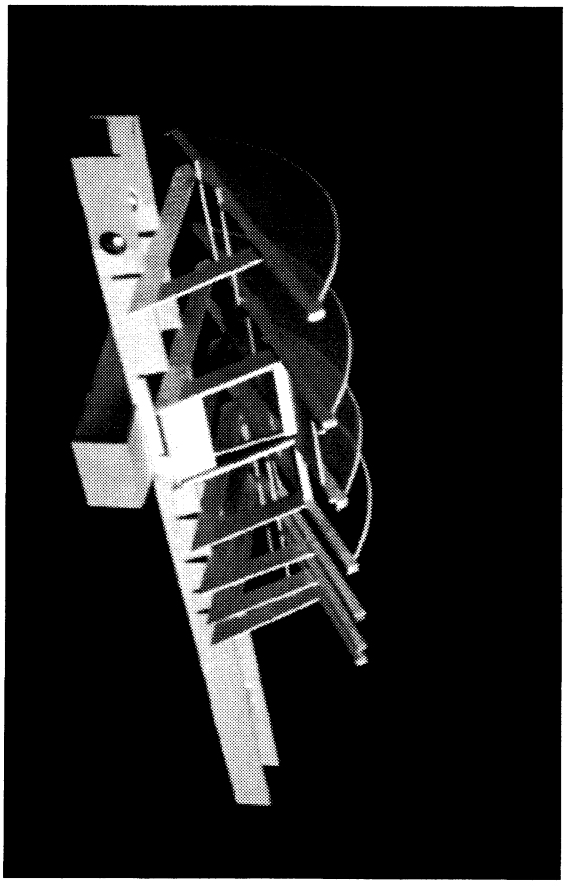
Based on the analysis of the precedent studies, one archetype was developed for each element: sun, wind, water and earth. Each archetype consisted of a written problem statement, a discussion of the problem and a proposal of a future design solution.

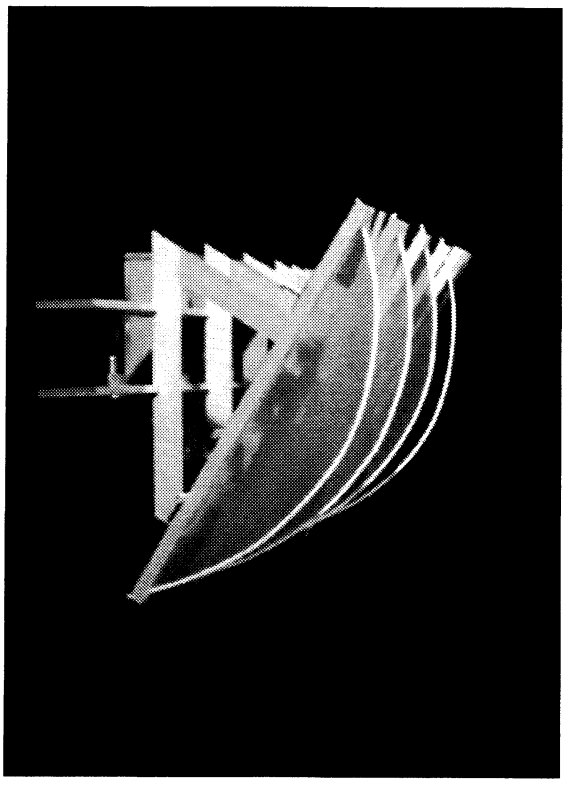
Readings

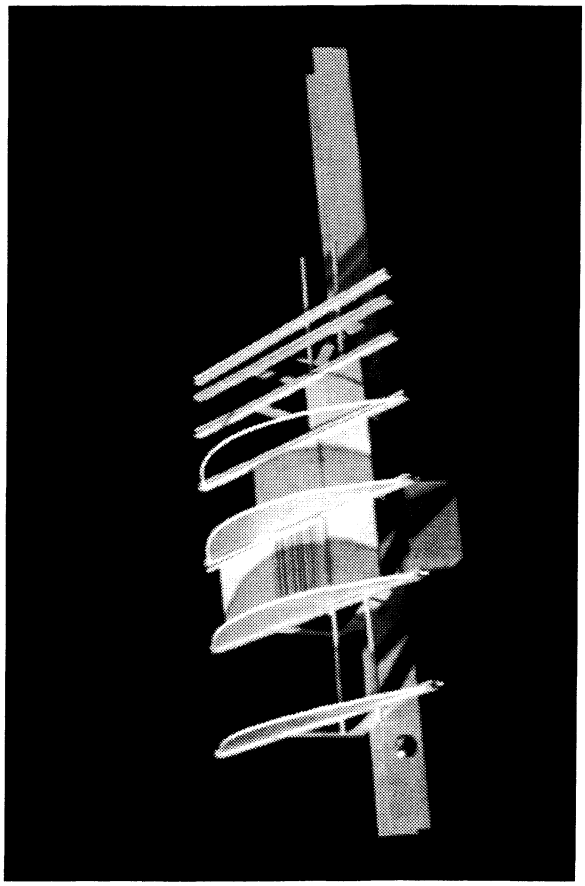
Selected readings in literature that capture the relationship between humanity and nature found in culture, environment, ecology, history, landscape and architecture were used to present various perspectives. The discussions took place on-line rather than in the classroom. Given the flexibility of on-line discussions the responses were thought provoking, thoughtful and thorough in development. Students who normally would be too intimidated to speak in class found a voice in writing.

Technology Presentations

Presentations were developed as group projects focusing on using the four elements, sun, wind, water and earth, as qualitative and quantitative resources. Questions that were addressed included: What can history teach us? What is the current technology? How is it being applied to building design? What are the implications in regard to low impact design? What are the aesthetic implications? Through research and project development each group became resident experts.







Figs C. D. + E: Wind Archetype—The concept proposes using hinged panels to control ventilation through the building. The panels allow for the release of warm air and the shading of the summer sun.

PROCESS

The goal of the course was to create a paradigm shift in how students develop their designs. A portion of each class focused on experiencing and connecting with the resource that was being studied. For example, when we focused on the sun we spent time outside sitting quietly and observing. We felt the warmth of the sun and its energy as we sat in direct light. We noticed the difference when we moved to the shade. We observed the light patterns that were created and how they changed over the course of the three-hour period of the class. We looked for examples that portrayed the effects of the sun-dried and cracked earth, fading color on a building, the direction a tree grew when it was partially shaded by a structure. These exercises were used for wind, water and earth as well. The exercise gave us the foundation for developing the poetics of designing the archetypes.

The experiences were then coupled with studying the technical aspects of the sun, wind, earth and water. The class researched current technologies and applications available. Through an understanding of the technical applications, coupled with the poetic details, students better understood the implications of their design decisions.

OUTCOME

Based on class discussions at the end of the semester, the course offered students a new perspective on the use of natural forces as guides to designing buildings. I believe the greatest outcome was in raising the students' awareness about the impact that their actions as designers may have on the future and making them mindful of their actions.

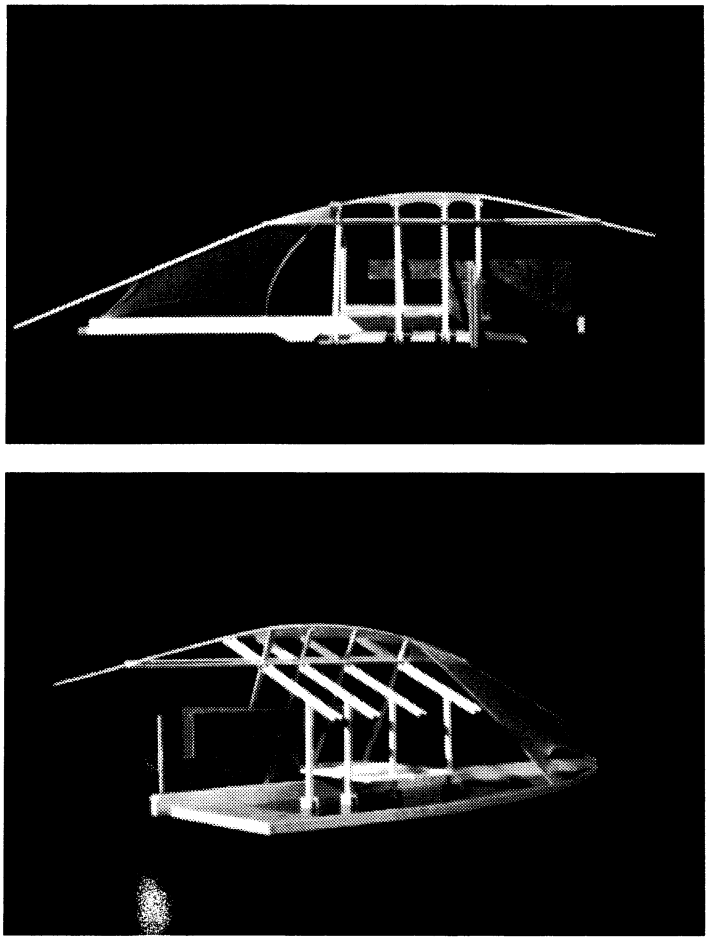
The precedent studies served as a great resource for studying historic and contemporary examples of how the earth, wind, sun and water were used in design. Since the research was documented in digital format as well as hard copy, the students developed their own resource catalog and will use the information in design studios.

The archetypes worked well as an exploration of design possibilities and solutions. Each student defined a specific problem and proposed a solution through his/her conceptual models. These conceptual ideas will be incorporated into future studio projects.

The group projects offered an opportunity for collaboration. The technical aspect of each resource proved to be valuable in assessing the impact of students' designs.

Upon the completion of the precedent studies, archetypes and research projects, each student was asked to develop a proposal for a final project as a means to apply the information gained in the semester. The criteria used for the final project included use of the sun, wind, earth or water, and a final assessment of the impact of the design on the landscape and natural environment. The project could be developed in model and drawing forms, a research paper could be written, or a combination of the two could be used.

Final projects ranged from redesigning rowhomes in Indonesia that use the sun passively, the wind to develop better ventilation, the roof as a poetic detail for capturing the water and the earth to build high upon, to a paper written on Sick Building Syndrome and its effects on us and our health by being disconnected from natural ventilation.



Figs F+G: Water Archtetype—This concept reflected the use of water in the home. By studying cultures that use water as a form of protection the proposal considers the structure surrounded by water and the use of evaporative cooling.

CONCLUSION

The purpose of the seminar course was to present to students an alternative way of thinking and contemplating design within the relationship of nature as a guiding force. My goal was to collaborate with students in research, readings and exercises to begin to understand the overall impact that our built environment has on the natural environment. The information explored in the seminar is being applied to the development of projects in the sustainable design studio.

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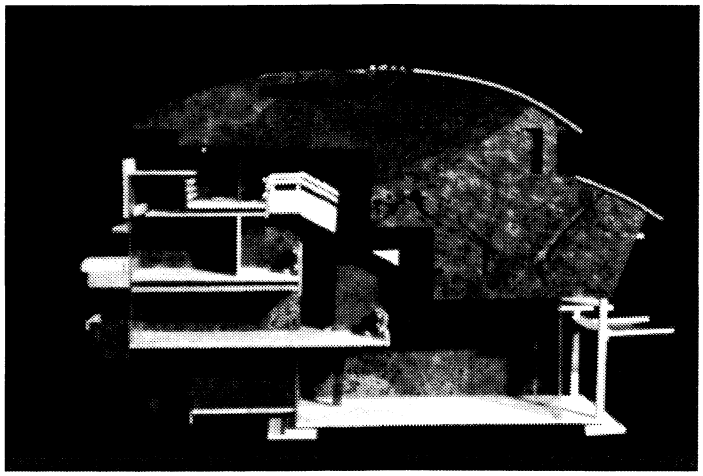

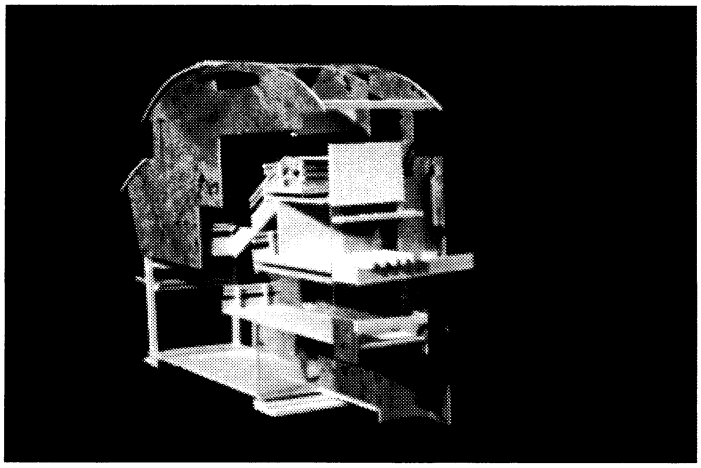

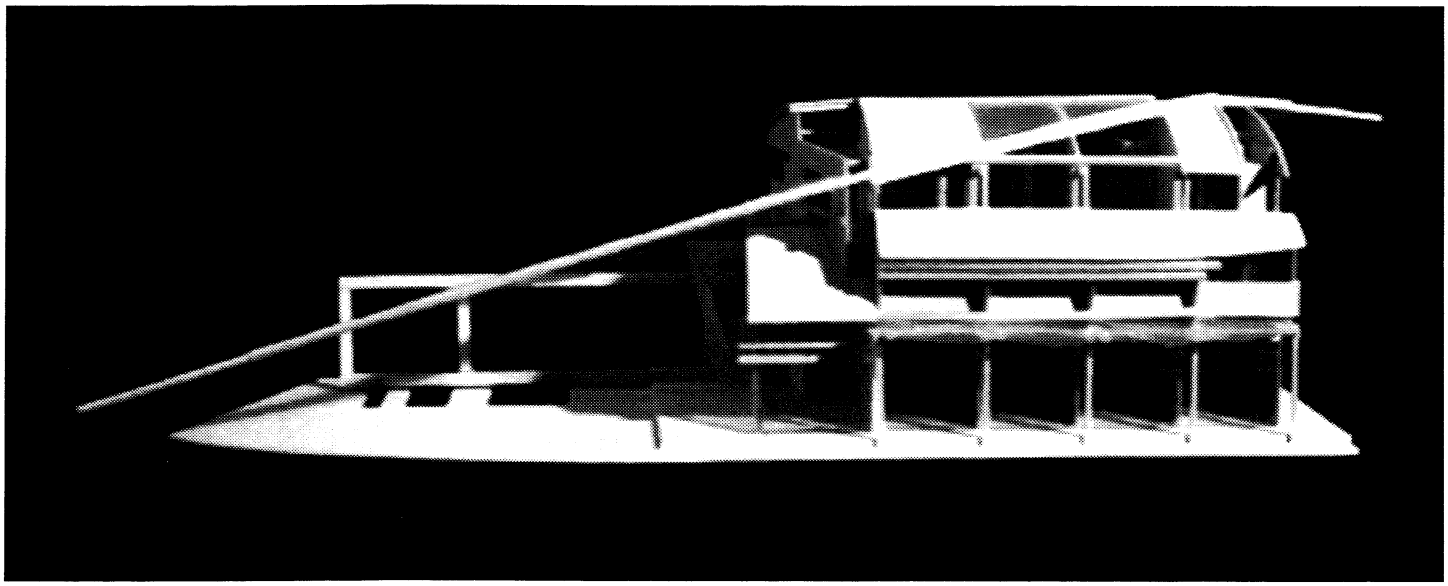

Figs H. I. + J: Final Project—Two final projects were developed using the archetypes as a foundation. Project H and J propose the use of wind, sun, and water as elements to bring comfort to a standard Thai rowhouse by opening the volume of the space and allowing for solar gain, ventilation and cooling. Project J uses the same principals for a corner lot condition.

REFERENCES

McHarg, Ian L. *Design with Nature*. New York: John Wiley and Sons, Inc.,1992.

Roszak, Theodore. *Ecopsychology*. San Fransisco: Sierra Club Books, 1995.