

Bridging Sustainability to the Studio Setting

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INTRODUCTION

The issue of sustainability is of central importance to the work of architects and therefore it is imperative that this topic be communicated to students of architecture. In *Our Common Future*, sustainable development is defined as “meet(ing) the needs of the present without comprising the ability of future generations to meet their own needs.”(1) Needs are defined in three dimensions – environmental, economic, and social. This definition can imply that continuing the present form of world development with simply much greater care constitutes sustainability. David Orr addressed this concern by differentiating between technological sustainability and ecological sustainability. The focus on ecological sustainability draws us away from an approach of management and adjustments of the global systems to recognizing that there are “limits to technology, limits to material wants, limits to the stress placed on the biosphere, and limits to hubris.”(2) Steven Moore proposes that “a regenerative system provides for continuous reproduction, though its own functional processes, of energy, materials and the human practices engaged in its operation.”(3) This defines sustainability as a social construct with political ramifications and as such it must grow from the community. The act of meeting the needs of present and future has limits to development in order to allow for regeneration of the earth’s natural and human systems.

SOCIAL

The dependency by the developed regions of the world on fossil fuels and world resources has created a global imbalance between the developed and the developing regions. As an example, about one quarter of the world’s population is using three-quarters of the annual use of energy and resources.(4) To redress this condition, the approach to sustainability should be a regenerative process to the fullest extent. To some degree, there are indications of this process occurring. In architecture, sustainable design has gained prominence in Europe and

recently in North America in both pedagogy and practice. This *current architectural paradigm should be measured against the extent of redress*. For sustainable design to have significant impact on the world condition, the present trend of energy and resource conservation needs to be redefined to a form of architecture accessible by the majority of the global community.

ECOLOGY

As the social aspects of sustainability start with the community, “ecological design occurs in the context of specific places.”(5) Ian McHarg, in *Design with Nature* focused our attention on the natural landscape as a model on which to base our approach to land-use.(6) By the careful study and documentation of place, we can begin to understand the complexity of the ecosystems in which we build and our connection to them. Our use of the land needs to be reconsidered. “It is not just a matter of fine tuning....what is needed is redesign.”(7) We can define “(re)design as the intentional shaping of matter, energy and process to meet a perceived need or desire. Design....connects culture and nature through exchanges of materials, flows of energy, and choices of land use.”(8) There is now a body of knowledge on which to base our ecological design. It is of the utmost importance to the student is that we incorporate this knowledge in our teaching.

TECHNOLOGY

By the rejection of “the notion that technology in itself might be an autonomous agent capable of liberating humans from the oppressive natural and/or social conditions of place.” we can begin to make informed choices as participants “in the construction of integrated cultural and ecological processes”(9). In architecture, these choices need to be based on the most informed building science available applied within a social and ecological context.

DAYLIGHTING

In her book, *Daylighting for Sustainable Design*, Mary Guzowski poetically positions daylighting as one of the key elements in moving sustainable design beyond the issues of energy and natural resources. "Aesthetics, beauty, health, well-being, and quality of life are as important to sustainable design as are reducing waste, energy consumption, and environmental impacts."(10) She states "that this triad – environmental, architectural, and human considerations – needs to be woven together in an ecological or sustainable approach to design."(11) It is the inclusiveness of daylighting that makes it central to bridging the gap between the pluralistic/technical approach and the individual/aesthetic and between the lecture/lab and the studio/design.

THERMAL EXPRESSION

Architecture and light have established expression that has a vocabulary and voice. "Our experience of light is connected to specific places where light contributes to the identification of a genius loci, ... climate is also a defining element of genius loci."(12) If we use daylighting as our foundation for the pedagogy of sustainable design, we create an opportunity to form a connection between the recognized aspects of light and space to the more difficult task of understanding thermal performance and expression. "No space, architecturally, is a space unless it has natural light..."(12) "So this is a kind of invention that comes out of the desire to have natural light."(13) Thermal expression has not developed the same degree of voice. The status of thermal performance needs to be elevated to the same level of consideration. We must develop the desire to express the thermal condition to same degree as our desire to express natural light. Out of this desire will come the inventions of thermal expression. This engagement with thermal expression has form-making choices. These choices are the making of the collective. "Engineering is not one thing and design another. They must be one and the same thing."(14) We might define thermal expression as those elements that reveal thermal performance. This conjecture recognizes that thermal properties of the envelope have a similar degree of fluidity as does the ebb and flow of daylight. The envelope is not a barrier; rather it is in constant connection and interaction with the changing conditions of the environment. Buildings then are never static and are always engaged with the site. The recognition of place in our architecture provides the opportunity to express the thermal condition. This expression can have delight, affection, and sacredness (15); it can provide our architecture with substance and a sense of permanence.

APPROACH

The approach to introducing sustainability to the design student progresses from broader aspects to the more focused.

We might state these aspects of the approach in the following order.

Social / Community
Ecology / Garden
Technology / Integration
Daylighting / Connection
Thermal / Expression
Team / Individual

This listing of aspects of sustainable design in the approach is included here to provoke inquiry. The approach is offered not as a set program that might be useful elsewhere, but rather as an on-going search. This search is an attempt to find a balance between the need of the individual student to gain a threshold on design and the need to comprehend global conditions. This premise is based on the belief that all design must be sustainable.

PROCESS

It is useful for the design student in the studio to move to a more focused process. The approach to integrating sustainability into the design studio is then based on a wider view of sustainable design, a regenerative architecture. At the same time, it is felt necessary to have a focus to this view that gives the student a starting point. That is not to say that the issues above need be comprised, only that the focus is directed to the act of creating sustainability, the act of designing. "Sustainability needs to be firmly grounded in the nitty-gritty details of design. Policies and pronouncements have their place, but ultimately we must address specific design problems."(16)

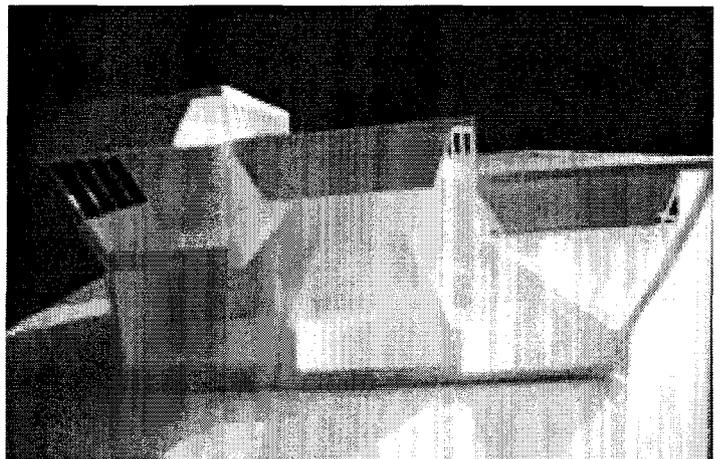


Fig. 1. Lecture/lab – Chicago Team*
Early daylighting model study.

The pedagogy first introduces a design project in the energy and systems lecture course in the fall of the fourth year of the architectural studies program.(17) The students work in teams during the term on the design of a small architectural office.

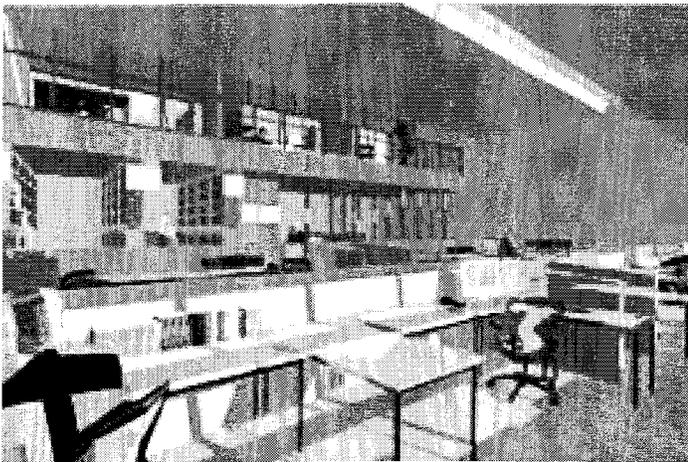


Fig. 2. Lecture/lab – Chicago Team
Daylighting digital study.

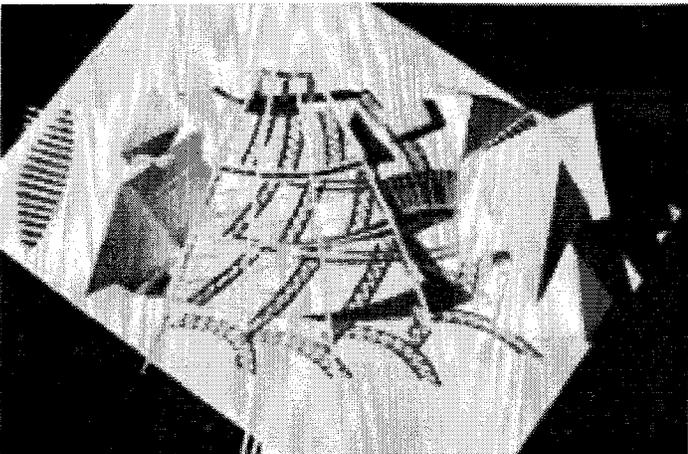


Fig. 3. Lecture/lab – Chicago Team
Structural/massing integration.

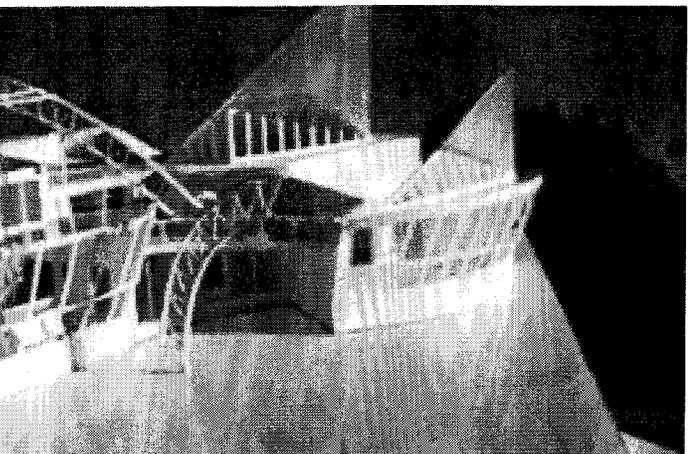


Fig. 4. Lecture/lab – Chicago Team
Top lighting, direct solar gain and wind scoops.

The student teams select their site in a *brownfield*(18) area from one of four cities: each located in different climatic regions in North America. What the approach seeks to accomplish is to develop the ability to provide for the conditions for human comfort in partnership with the attributes of the site.

The process begins with one room—the studio of the office. The room is then connected to an outdoor space. Daylighting alternatives to the room are studied in model form and are photographically recorded. In some cases, a digital format is used. (Fig. 1 and 2) With emphasis on the quality of the lighting obtained, the differing lighting conditions of the alternatives are analyzed.(19) The students investigate the natural landscape found in their area of study and how it might be incorporated in the urban form. During these observations, the questions of climate and connection between the interior and exterior are discussed in the lab portion of the course. The remaining program requirements are then added to the design process. The project starts with the following statement by Louis I. Kahn.

“In doing a memorial I started with a room and a garden. That was all I had. Why did I choose a room and a garden as a point of departure? Because the garden is a personal gathering of nature, and the room is the beginning of architecture.

The garden has to do with nature as it applies to a place that has been chosen by man and is developed for man’s use in a certain way. The architect becomes the advocate of nature, and makes everything in the deepest respect for nature. He does this by not imitating it at all, and not allowing himself to think that he is a designer – if he imitates how, let us say, the bird plants the tree. But he must plant the tree as man, a choosing, conscious individual.

The room is not only the beginning of architecture; it is an extension of self. ...The large room and the small room, the tall room and the low room, the room with the fireplace and the room without, all become great events in your mind. You begin to think, not what are the requirements, but rather what are the elements of architecture that you can employ to make an environment in which it is good to learn, good to live, or good to work.

Also marvelous in a room is light that comes through the windows of that room and that belongs to the room. The sun does not realize how wonderful it is until after a room is made. A man’s creation, the making of a room, is nothing short of a miracle. Just think, that a man can claim a slice of the sun.”(20)

We use daylighting to connect the room to the garden. Passive strategies for heating and cooling are then incorporated into the

design following the methodology provided in the course text.(21) The design work, with the consideration for human comfort, proceeds over the term in three parts: preliminary strategies; use of design guidelines, adjustments, and calculations; and finally comprehensive systems for the building and site. The project is documented in model, report and digital formats and presented by each team.(Fig. 3 and 4)

It is recognized in the approach that by emphasizing daylighting there can be a conflict with obtaining good thermal performance. The focus of the process is that a careful balance between the two must be maintained. In cooling conditions, the need for shading and natural ventilation may be paramount. In heating conditions, the need for thermal storage increases. As the students move through the application of the early thermal strategies in conjunction with their daylighting approach, they begin to understand the interaction of the two. The use of the design guidelines allow for easy adjustment. The study models are pinned, not glued. The students themselves do the evaluation of the work. The final detail calculations confirm the thermal performance. It is the student's recognition of these issues that is the most important outcome of the process.

The students proceed individually over the spring term in the senior design studio on a terminal project for the architectural studies program. The focus placed on sustainable design in the fall course is carried forward to the spring studio with an emphasis on integration. (Fig. 5 to 8) The course concentrates on the design and comprehensive documentation of one project. By developing the ability to integrate sustainability in a simple team project, the gap is bridged between the technical lecture course on the subject and individual student's incorporation of sustainability into a comprehensive design in the studio setting. (Fig. 9 to 12)

EVALUATION

Evaluation of the approach focuses on the student work in both the lecture course and the design studio. As in the project statement above, the writings of Louis I. Kahn can be useful in the evaluation process. Does the architecture created have substance? Is it born of place? Does it work? "Client: Well, now that we have the general form, we have to put in all the guts and see if we can fit them in. Kahn: If they don't all fit in easily and properly, then we have the wrong form."(22) Sustainable design extends this requirement of function over time. Does it speak to the issues that define lasting architecture, a sense of permanence with the ability to change over time, to adapt to new uses and conditions? "I don't like to see space nailed down. If you could move it and change it every day fine"(23) "Of course there are some spaces which should be flexible, but there are also some which should be completely inflexible. They should be just sheer inspiration...just the place to be, the place which does not change, except for the people who go in and

out."(24) Permanence is a response to place. We build community with permanence that has the ability to change. Has the student work obtained a balance between permanence and change? Are there spaces that seek sheer inspiration?

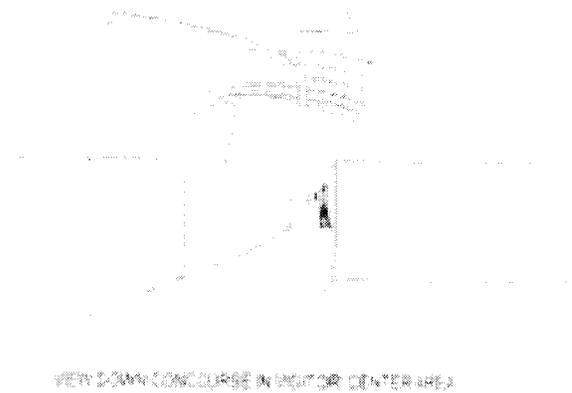


Fig. 5. Senior studio
Sketch interior study – design approach similar to the fall lecture/lab.

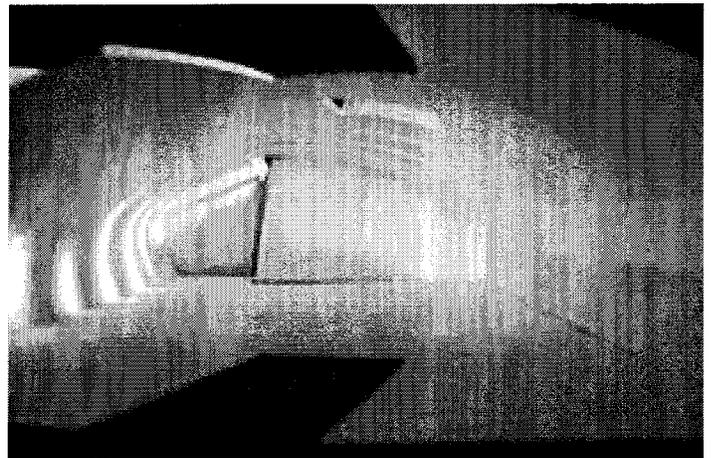


Fig. 6. Senior studio
Model interior study – development of daylighting.

Does the architecture have integrity? "Structure is the giver of light."(25) "It is much better not to cover anything up but to show the full nature and relationship of part to part, including the present condition of which is a record of how it got that way."(26) What is the quality of daylighting achieved? Does the design express the thermal conditions of place? "The world cannot be expected to come from the exercise of present technology alone to find the realms of new expression... technology should be inspired. A good plan demands it."(27)

Has the student developed critical thinking skills with respect to the environment and sustainable design? We express our thoughts through our interest and engagement. Is there an

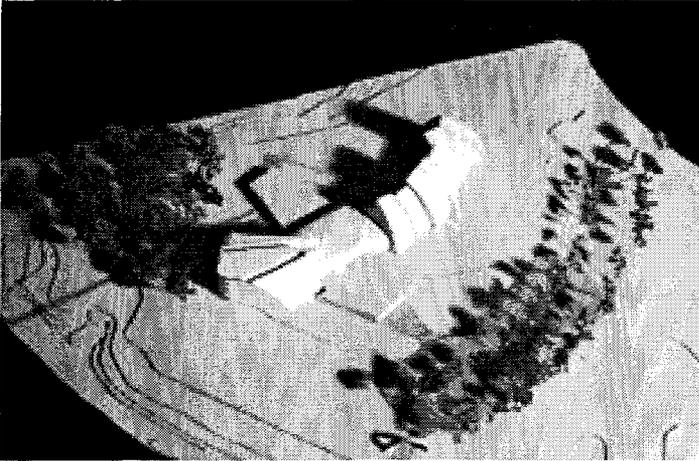


Fig. 7. Senior studio
Comprehensive design – site and massing response.

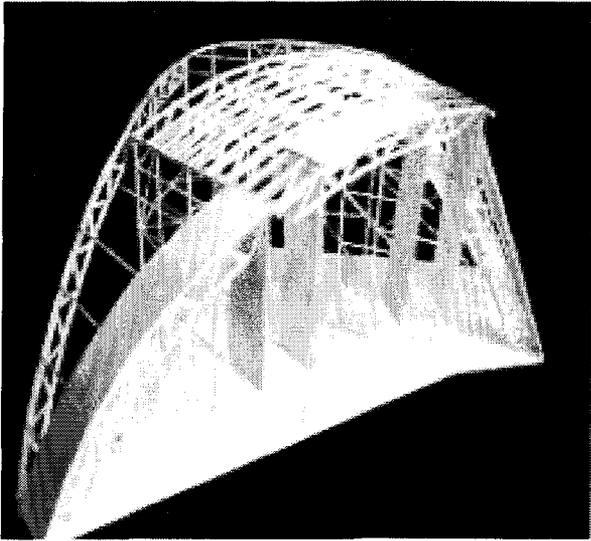


Fig. 8. Senior studio
Structural integration – integration of structure, daylighting, and thermal performance.

interest in issues beyond our immediate culture? Are students becoming engaged with the community and the world condition?

The final evaluation of the students work must go beyond the measure of the success of any one issue of sustainability. It must focus on the critical evaluation of the overall quality of the architecture produced. At the same time, this is not stated to lightly pass over the challenging evaluation of each element that forms the final composition we think of as an architectural entity. The measure of excellence in daylighting and thermal performance is just one of the many aspects of sustainability that must be fully explored and documented. The success of the approach is that the students involved in the process are the future participants in this exploration.

CONCLUSION

Sustainable design is a social construct that directs our architecture to the global condition by focusing on *place*. By applying ecological principles architecture can connect us to our environment. Our technology can be applied in this social and ecological context as one tool that redresses the imbalance in the world condition. Through the use of daylight, we can introduce the moods and temperament of the day and season and we can obtain an affinity for our thermal condition. Our architecture can have thermal expression that speaks to the *place* in which we live.

Our pedagogy can offer our students an understanding of the context in which to apply our building science. They need the opportunity to *play* in the realm of the “measurable and the unmeasurable....at the threshold between Silence and Light”.(28)

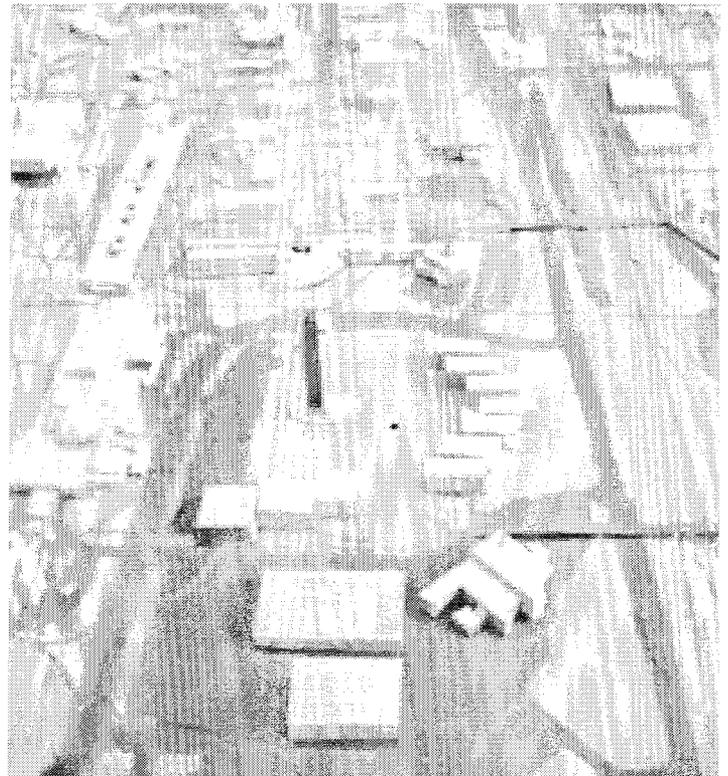


Fig. 9. Senior studio
Site Analysis – building orientation and massing.

We can evaluate our process by how well the student connects the room to the garden. How well does the structure give light? How well has the design expressed the thermal condition of *place*? Does the design speak to permanence? Is the student engaged?

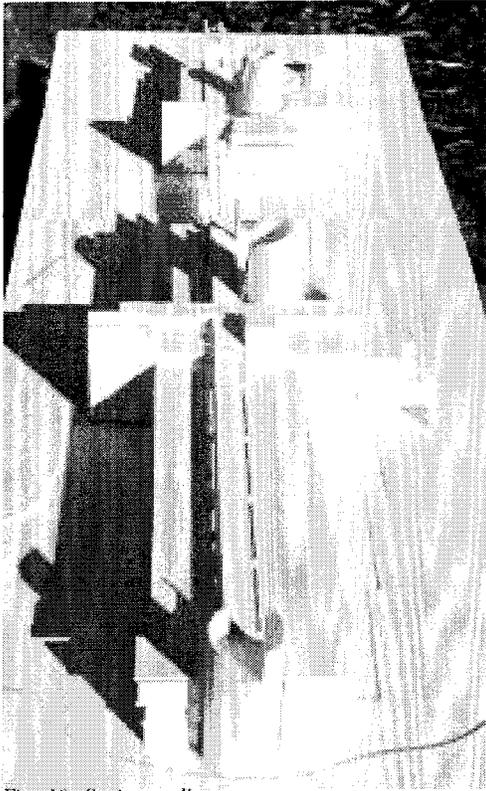


Fig. 10. Senior studio
Climatic response – stack action used with building circulation to connect the building to the campus.

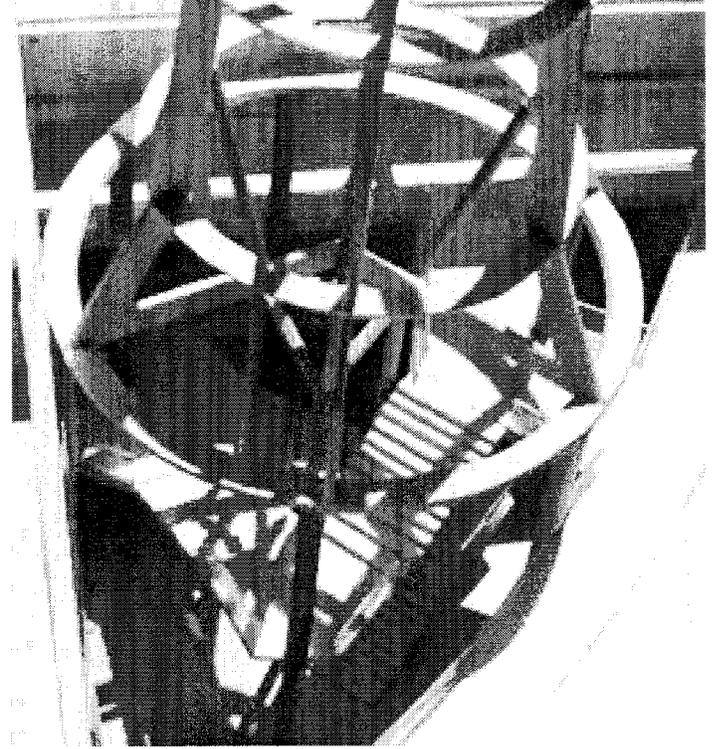


Fig. 11. Senior studio
Design development – integration components.

NOTES

¹ World Commission on Environmental Development. *Our Common Future* (New York: Oxford University Press, 1987), 43. The statement includes that a development, which can be sustained, will meet important needs in three dimensions: *Environmental* – Maintenance of clean air, water, soil, a variety of species and their habitats, as well as global climatic stability; *Economic* – Production and distribution of wealth in a manner that provides access to the goods and services necessary for a good quality of life for both present and future generations; and *Social* - Developing a community to function as a safe, healthy, and viable setting for human interaction, education, employment, recreation, and cultural development.

² For a fuller discussion and referencing of David Orr's position see Sim Van Der Ryn and Stuart Cowan, *Ecological Design* (Washington, D.C.: Island Press, 1996), 4-7. This quote found on page 7 is a good statement of the need for limitations in what we do as a society.

³ In this context, I include the term regenerative architecture proposed by John Tillman Lyle, *Regenerative Design for Sustainable Development* (New York: Wiley, 1994) and expanded in Steven Moore's Eight Points For Regenerative Architecture: A Nonmodern Manifesto is a useful references to fully convey the issues involved. Steven Moore, *Technology and Place: sustainable architecture and the Blueprint Farm* (Austin: University of Texas Press, 2001), 198-201.

⁴ For a good general discussion of these subjects in architectural terms see David Lloyd Jones, *Architecture and the Environment: Bioclimatic Building Design* (Woodstock, N.Y.: Overlook Press, 1998) and Sophia Behling and Stefan Behling, *Sol Power: The Evaluation of Solar Architecture* (Munich: Prestel, 1996)

⁵ Sim Van Der Ryn and Stuart Cowan, *Ecological Design*, 23.

⁶ Ian McHarg, *Design with Nature* (New York: Wiley, 1992)

⁷ John Tillman Lyle, *Regenerative Design for Sustainable Development*, Preface ix.

⁸ Sim Van Der Ryn and Stuart Cowan, *Ecological Design*, 8. See their five principles for The Ecological Design Process and John Tillman Lyle, *Regenerative Design for Sustainable Development*, 37-45. These approaches and others are compared and analysed with respect to daylighting in Mary Guzowski, *Daylighting for Sustainable Design* (New York: McGraw-Hill, 2000), 387-399.

⁹ Steven Moore, *Technology and Place: sustainable architecture and the Blueprint Farm*, 198-199.

¹⁰ Mary Guzowski, *Daylighting for Sustainable Design*, XXV.

¹¹ *Ibid.*, XXVI.

¹² Marietta Millet, *Light Revealing Architecture* (New York: Van Nostrand Reinhold, 1996), 6.

¹³ Louis I Kahn, *Light Is The Theme* (Fort Worth: Kimbell Art Museum Publication Two, 1975), 15.

¹⁴ *Ibid.*, 17. The invention in this case is the light reflecting element in the Kimbell Art Gallery.

¹⁵ *Ibid.*, 50.

¹⁶ These qualities are chapter headings of Lisa Hescong's inspiring book on the subject. Lisa Hescong, *Thermal Delight in Architecture* (Cambridge, MA: The MIT Press, 1979) 16. Sim Van Der Ryn and Stuart Cowan, *Ecological Design*, 57-160

¹⁷ The course is required in the pre-professional program in the Department of Architecture and Interior Design at Southern Illinois University Carbondale. It is part of a triad including Environmental Design I: Site Planning, Environmental Design II: Lighting and Acoustics and Environmental Design III: Energy and Systems.

¹⁸ A *brownfield* site is used to inject the issues of urban depletion and the importance of community issues in sustainable design.

¹⁹ It is interesting to note that Louis I. Kahn started his Master's Studio at the University of Pennsylvania with the student studying the daylighting of a

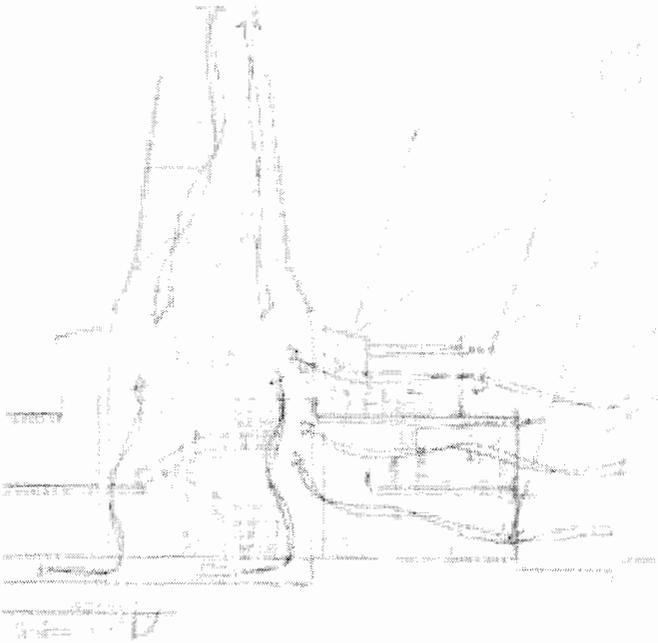


Fig. 12. Senior studio
Thermal expression/performance – stack maximize of building action and natural ventilation.

simple model of a cube shaped room. The study included photographing various daylighting alternatives for the space.

²⁰ John Lobell, *Between Silence and Light* (Boston MA: Shambhala Publications, 1997), 38.

²¹ Benjamin Stein and John S. Reynolds, *Mechanical and Electrical Equipment for Buildings* (New York: Wiley, 2000) and Mary Guzowski, *Daylighting for Sustainable Design* (New York: McGraw-Hill, 2000). Additional course readings are suggested from the material referenced in this paper.

²² Louis I Kahn, *Light Is The Theme*, 50.

²³ *Ibid.*, 47.

²⁴ *Ibid.*, 27.

²⁵ *Ibid.*, 21.

²⁶ *Ibid.*, 59.

²⁷ *Ibid.*, 60.

²⁸ John Lobell, *Between Silence and Light*, 3.