"The Really True Story of the Big Bad Wolf and the Three Little Pigs:" Integrating the Tactile and Technical in the Beginning Design Curriculum

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THE SCENARIO:

...yes, we all remember that story. It may be a "fairy tale," but the images are vivid and the foolishness is real. Where architectural design chooses to ignore the implications and potential of the tactile and the technical, in both education and practice, the results can be disastrous.

The architectonic needs of contemporary society are being shaped by cultural issues emanating from the economy, technology and the environment. Architecture, as a manifestation of cultural preoccupations, is required to respond to these necessary issues. Education practices which have separated technical and environmental issues from the design studio have seldom been successful in graduating Architects who are readily capable of coherently integrating these issues into design and practice.

The student's enduring vision of architecture and its relationship to design, technology and the environment is formed by the attitude and directions of the first and second year curriculum. The manner in which technological ideas, concepts and facts about building science, climate, structures, construction and the environment are introduced to first year design students is of paramount importance as it sets the tone for all subsequent teaching in the field of design and technology. The beginning design curriculum must be refigured to address the broad concerns of contemporary society in a more pedagogically entwined manner than has routinely been accepted in order to "bridge the abyss" that often exists between technology/environment and design. This paper examines an early design curriculum in light of its vital integration of the technical and environmental in design projects and teaching pedagogy.

The story of "The Big Bad Wolf" can be reinterpreted in terms of contemporary education practices — who are the players and what is their agenda?

THE CAST

Big Bad Wolf:

The demands on architectural design of the current economic, technical and environmental conditions

Straw House Studio:

Let's design architecture that looks good and feels good — big brother pig will take care of the details! (aside: This notion does not refer to straw bale construction whose technical and environmental concerns are more closely linked to Brick House Studio ideals.)

Stick House Studio

Broad design focus — pays increasing heed to the tactile and the technical in developing a positive attitude towards Big Bad Wolf criteria

Brick House Studio

Let's make "Super Architects!" — design + technical + environmental expertise in combination on all projects.

> ...the big bad wolf crosses over the abyss and visits the design studio. He's not such an intimidating character after all — if we are ready for him.

THE DEVELOPMENT OF THE INTEGRATED CURRICULUM:

The vast majority of early design studios operate as Straw House Studios. Many studio professors are reluctant to include technical considerations as project requirements. The reasons are many, but largely they reflect both a fear of inhibiting creativity by burdening students with technical issues, as well as a sense of technical insufficiency on the part of non-practitioner faculty. The beginning design student does not initially share these problems and are initially willing to absorb and integrate all aspects of the curriculum.

The projects illustrated within this paper speak to an increasingly integrated early studio and technology curriculum — posturing the case of the Stick House Studio. The curriculum has been developed to inspire creativity and a critical architectural discourse by asking students to connect with an understanding of the impact as well as potential of technical, environmental and regional climatic considerations on design. The scenario postures that significant faculty who teach technology, also teach in the parallel design studio — and that the design faculty highlight the tectonic aspects of design. If the faculty cannot integrate the material, why should we expect this of the students? The students (and faculty) have found this activity to be far less burdensome than feared — rather, intellectually stimulating, producing higher quality design projects whose design exhibits a deeper understanding of a wide range of parameters.

In order to effect integration, it is equally important for technology and environmental courses to focus on issues of design, as for design to recognize the impact of issues of technology. Courses on building construction and environmental concerns are taught with a design focus employing a series of parallel lectures timed (as much as is practical) to feed into the of concerns and project scale of the parallel design studio. Timing is a difficult but essential factor in the creation of an integrated approach to teaching. Students are most interested in topics that aid in solving the problem at hand, and which are able to be readily incorporated into design problems.

The pedagogical basis for courses in construction and the environment is two-fold. The first position postures that there is an essential intrinsic interdependence between conceptual design and the structural choice and materiality of a building.[1] One material or system may not be randomly switched for another without detriment to the design. The examination looks at the history of material development as it informs the evolution of modern design, general details as well as specific building case studies. This process builds on a rich architecturally design oriented conceptual base. A thorough understanding of the intrinsic interdependence of conceptual design, constructional materiality and bioclimatic considerations assists in alleviating the inevitable result of the Straw House approach — that is, blind dependency on the engineer and technologists. This notion of conceptual interdependency is carried over to the tactile design studio project which will normally specify a range of materials suited to the building type or scale and a specific site. This limited material range and assignment of a site with zoning requirements provides a focus for questions and extended discussion within the studio.

The second position maintains that the bio-climatic state of a building must be considered at the outset in recognition of appropriate regional aspects which must be accounted for during conceptual development of the design; i.e. what is suitable in the hot-arid climate of Arizona will not be able to be built in the cold climate of Minneapolis without major modifications to the building concept and design — or, without unnecessary consumption of fossil fuels to balance the conditions. This "green" position is slower to bridge the gap between the tactile/technical and the design studio. The pedagogical basis for the teaching of environmental considerations maintains a return to pre-international design acknowledgment of the importance of the climate and the potential of vernacular forms in architectural design — Passive and Sustainable design. At the very least, early design students learn how to orient their buildings to take advantage of the sun, use natural ventilation practices and recognize both the potential and limitations of the climatic region in question.

The technology and environment courses, in their constant reference to actual case study buildings, look at detailing from a less abstract point of view than is often the case and focus on the importance of technological choices and proficiency in design detailing in creating lasting, significant architecture. The illustration of building failures, especially those whose life span has been relatively short, makes a lasting impression on students. When such buildings have been designed by "heroes" or "masters," students are appalled. Issues of Sustainability and the depletion of nonrenewable resources figures an active role in the selection of materials and overall quality. Students gain a clear understanding that proper detailing and material selection is imperative to attain durability and longevity as well as the impact of regional vernacular, climate on design choices.

THE PEDAGOGY OF THE STICK HOUSE CURRICULUM

There are two polar approaches to design: naive design modified by technology; or, proficient technical knowledge that informs all decisions. Advanced technological knowledge can permit informed creativity, however in many situations, the Straw House curriculum would argue that imaginative applications are restrained by fear of technological failure. The Stick House pedagogy maintains that if innovation through exploration is a goal in the design studio, that naiveté and intuition can prove to be effective initiators and provide a fruitful conclusion if followed by critique and appropriate information.

The first and second year curriculum commences with explorations which spring from an intuitive/exploratory approach and progresses to design projects which expect more fully informed decision making. Interim projects operate at a transitional level; i.e., as information is received, the approach becomes more synthesized, expecting increasing levels of understanding, integration and sophistication. The projects of the Stick House Studio include issues of the tactile and the technical on varying levels, as are appropriate to the particular project. Where some technical, structural or material centered issues may become the primary pedagogical focus of the design project in the early years, it is ultimately desired that they come to be addressed in a matter of course fashion as part of the normal list of project requirements. It is desired that the technical and the tactile become critical aspects that are routinely considered in the normal practice of design.

The focus lies in the interconnection that has been created primarily between the design studio and the technology (building construction, which includes climatic design) curriculum during the second two terms of the first undergraduate degree — that is terms 1B(winter) and 2A (fall). The pedagogical bases of these terms, and the alignment between the scale and focus of projects in the design studio, and the essential and related nature of the material addressed in the building construction courses which run parallel, has facilitated the initial bridging of the abyss.

> "Formerly, knowing and doing were in step with one another. The art student's creative impulse was roused and tested as soon as possible. He soon encountered things he had to know and which he was eager to learn in order to be able to proceed further. In this way he collected a store of scientific knowledge, perhaps not in an especially critical and methodical way but in a way that he grasped thoroughly and at once made use of artistically."
>
> Gottfried Semper preface to "Theory of Formal Beauty," 1856/1859

THE PROJECTS OF THE STICK HOUSE CURRICULUM

The exploration of the tactile and the technical in design is best served by projects which allow for a full investigation of the structural, constructional and material aspects of design choices. A range of project/media types is employed which allows for varying approaches to be matched to the design inquiry. These may be generally subdivided into those of a two dimensional nature; i.e., drawings, and those three dimensional which involve construction at varying scales. These general project types are complementary; that is, that they each allow for the development of particular information specific to the format.

A. Three Dimensional Investigations

The use of models both as a design tool and a presentation technique is often seen as the best way of bridging the gap between design and construction. There remains, however, an inherent abstraction in the architectural model in the approximation of materials, scaled reduction of space, inconsistency in the structural properties of scaled or substituted materials. The "model" projects of the Stick House Studio exploit both the potentials and shortcomings of the medium. Taken as a whole, rather than examined each on its individual merit, the projects vary in their intentions to expose students to a range of options, applications and experiences.

Tectonics[2]

The premise of this project is to eliminate all of the difficulties associated with "models" through the construction of a "real structure" with consistent materials, albeit, at a modest scale. The construction is primarily structural in nature, and based on intuitive and empirical, rather than a mathematical understanding of structural principles. The students are required to explore the complex relationship between structure and aesthetics, between science and art, and between technology and culture in the design and "model" of a structure with specific material and dimensional constraints, which must support a steel sphere. From term to term the physical limitations and materials of the project are changed; from the dimensional parameters of the construction, to the

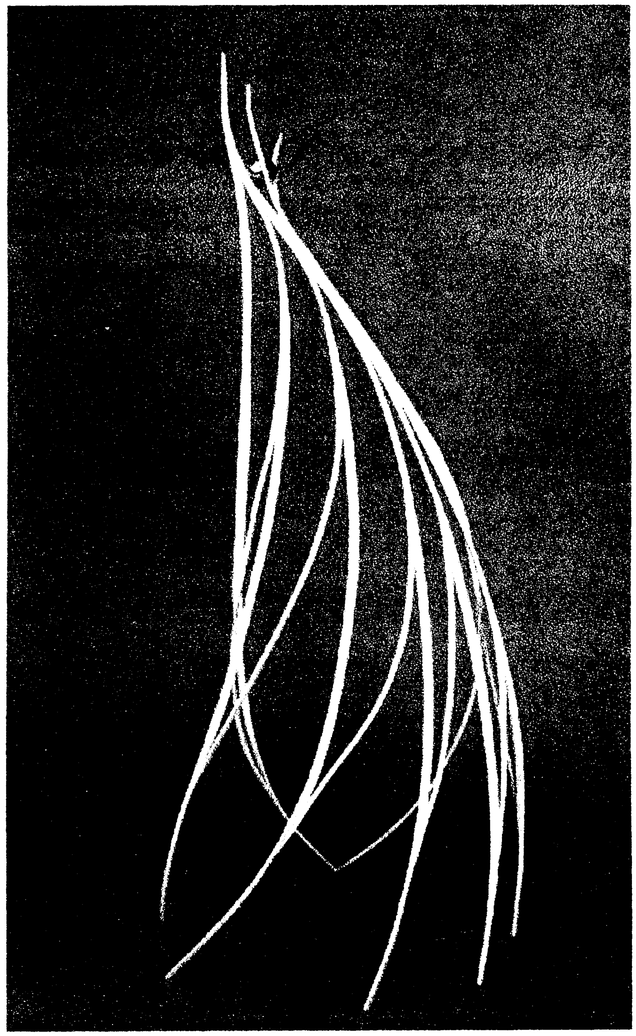

Fig. 1. Tectonics model by first year student Melana Janzen Fall 1995

Fig. 2. Students Paul Kulig and Matthew Hessey complete a sample masonry cavity wall

exact specifications of the materials and attachment methods, to the size of the sphere to be supported.

The act of design and construction, and the in-progress failures, provide as much a learning experience of the connectivity between materiality-structure-design, as do the resulting finished models, viewed and critiqued en masse.

Masonry Wall Building Exercise[3]

Within the building construction course which runs parallel to the first year studio, the students construct a fully insulated and detailed concrete block and brick cavity wall, which measures 3 feet in height and 4 feet in length.

This hands on experience with genuine materials extends the initial premise of "tectonics" as well as exploiting the contrast between fine and rough materials. The materiality of the project, that is masonry versus slender wood, broadens the knowledge base and provides a conceptual revelation of "compressive strength" versus "tensility." As the students during this term are also preparing two dimensional designs of masonry buildings, the wall building exercise gives them an appreciation of the imprecise nature of both the material and the construction process.

....Knowing and Doing... : The Program of the 2A Term

> "Our aim is to tackle design as a practice, an ongoing set of acts which is reflective and critical, and above all, purposeful.. The locus of the term is the design process..."

Contingency and the Obsession with Order: "The Large-Scale Wood Framing Model"[4]

The second year studio poses a three-part design problem. Initially each student designs a two car wood frame garage with a summer room. The second part of the problem requires the "ready" conversion the garage into "cold climate" accommodation for one to two persons. A series of the projects is selected by faculty. These buildings represent a range of wood framing types and detail design problems — pure light wood frame, heavy timber frame and composite construction.

The models are constructed in basswood or pine at 1:10 scale by groups of four students (excluding the original author). They are permitted to "correct" the original design to "make it work," but must retain the original conceptual intentions. Students use the span tables from the building code to size the members, and construction information from the first year building construction course of the previous term (which is reviewed at the time of the project).

In the first two three dimensional projects the students constructed without first drawing, using intuition and technique as the primary resources. The framing model provides most students with a realistic first time experience of the "leap" required when transferring technical construction information from paper to actuality, from two to three dimensions — hands-on and tactile. This project extends the level of difficulty and learning in the act of three dimensional representation as it approximates reality. The most difficult aspect of this project is the inability to replicate both the structural capacity and construction of the joints — 1:1 glue leads to a false sense of structural rigidity—which is addressed in the critiques.

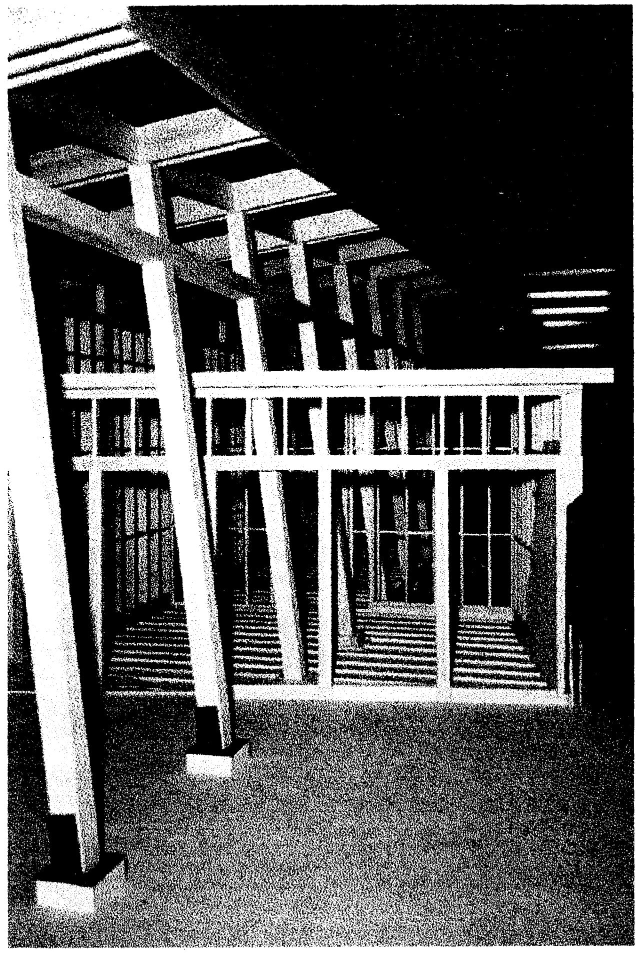

Fig. 3. Detail of large scale timber house frame model by 2A students Fall 1995

Domestic Implements[5]

Following the wood frame model, the studio requires students to design an architectural element which will be able to be employed on a repetitive basis in a multi unit residential complex — design of the building to follow immediately — as a means to establish a domestic space. Each implement must accommodate a series of functions which elevate their use from a single use to a multi-purpose set of activities. The element is presented only as a 1:5 scale model, to be painted white. Operable parts must operate.

The projects draws students into the detailed aspects of design: aesthetics, function, ergonomics and construction. The implements must be able to pass through a doorway during installation and be installed within a 4 hour time frame. This model project extends the previous three by

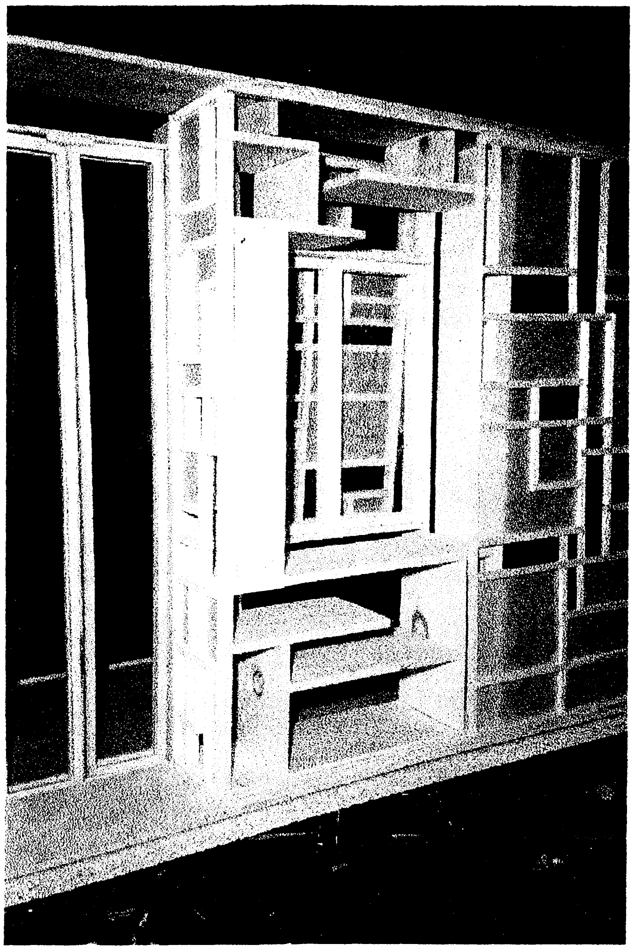

Fig. 4. Large-scale domestic implement: Window by Kaline Charrey, 2A, Fall 1995

adding the variables of portability, assemblage technique and time constraints. Although materiality is discussed, it is not a focal point of the exercise and model parameters.

B. Two-Dimensional Projects:

The emphasis on communication skills and drawings is critical to the beginning design pedagogy. Drawings are the barest means by which an Architect communicates conceptual design intentions, materiality and construction detailing. The first year curriculum has recently initiated a course devoted to media tools and presentation techniques. Drawing requirements for the design studio are precisely outlined with respect to type of medium, specific drawing views required, content (furniture, technical), drawing scale, and modes (plan, section, perspective). Normally a portfolio submission is required at the end of term.

The Continuous Environment[6]

This is the final project of the first year design studio. This five week comprehensive design project requires the students to design on an individual basis, a small building on a real site. They will incorporate ideas and designs from an immediately preceding project which focused on the design of interior space. The required documentation includes standard plans, sections and three dimensional constructions (including furnishings). Within the context of the studio, the students are also required to document the construction and tactile aspects of the design. This is the first time students prepare an integrated design/technical presentation and begin to understand the complexity of the full design problem.

The Concrete Block Design Competition[7]

The masonry industry, during these lean economic times, has been searching for "innovation" as a means to increase the use and market share of masonry in the construction industry. The Ontario Concrete Block Association's Annual Student Design Competition, which is now entering its eighth year, has provided a venue to encourage invention in masonry design by soliciting design solutions from architecture students in their early years of study. The students, through the initial building construction course, enter a legitimate province wide student competition which requires that they design and detail a moderately sized concrete block building. The buildings are judged by a committee comprised of both architects and industry representatives, on the basis of architectural design, material innovation and technical consideration.

The competition entries from the University of Waterloo have been typically drawn from first year students with minimal experience and technical knowledge. Within the program set out by the OCBA for the competition, innovation and creativity have been stressed over adherence to technical rigor. This has permitted lateral thinking and unencumbered experimentation, and made the competition a valuable addition to the first year curriculum. The school's programmatic and technical requirements with respect to the project submission for course credit have been kept quite open in order to encourage students to step beyond the technical bounds of the building construction course. Course presentation criteria require that the drawing focus be in the nature of a "structural axonometric" at 1:25 scale, a technical wall/ building section at 1:10 scale and a plan view at 1:50 scale. The competition format requirements for the boards are quite strict, and students prepare drawings in ink on mylar which are "photo ready" for compilation and editing in the submissions. The ability for an entire class to prepare bonifide competition entries is an invaluable experience. That the focus in "material" and "tactile," reinforces the significance of these notions to the design process.

The students' intuitive approach based on minimal structural knowledge has netted inventive solutions, albeit, many times to the point of impossibility in the traditional sense, and in most cases a significant distance from "safe," "compressive" construction methods. A retrospective look at the competition submissions would indicate that students have perceived innovation to require that concrete block be subjected to tensile stresses. In some instances such innovation has been criticized as being entirely unrealistic and unrealizable. However, if adjusted, understood and toned down, such innovation can lead to positive, viable solutions.

The Modernization Case Study[8]

This project was created in the second year building construction course to assist the students in developing a critical awareness of current performance standards for buildings and construction practices that reflect bioclimatic considerations. Students glean numerous ideas from periodicals or texts on modern architectural history, often without understanding the contextual or environmental considerations that may or may not have informed their creation. These ideas are often blindly transferred to studio design projects and eventually to built architecture. The modernization project creates a list of well known modern or contemporary projects of varying material or climatic origins. The typical wall section of the building must be redesigned from first principles to suit current thermal and building science standards in order to highlight and understand the ramifications of adapting to cold climate standards. The key to the investigation is the required adherence to the original conceptual intentions of the project. Cases have included the Farnsworth House (exposed structural steel), the Villa Savoye (reinforced concrete), Sea Ranch (timber) and the Lever House (curtain wall).

It has been enlightening for students to look closely at the technical drawings of existing modern buildings with an emphasis on critical inquiry. The scenario forces students to fully appreciate the connection between materiality, construction, detailing and design concept.

"Contingency and the Obsession with Order" — The Drawings: 9

The second year students are to design a single new building—a garage or carport to shelter two cars and accommodate a small summer room - in such a way that it is readily converted to a year-round dwelling building (cold climate) for one or two people. Actual accessible sites are assigned along with a minimal set of zoning restrictions based on the local bylaws (setbacks, height, area). The nature of the conversion is to be illustrated in a separate presentation in which there is an account for its insulation, vapour and air barriers, its lighting, and services. Students are aware at the outset the sequential nature of this project — including the timber model requirement.

The project highlights the connection between design and the technical. Critiques allow for a focus on the idea of "renovation" and the adaptability of buildings to new use with either minimal or major modifications.

...Beginning the Brick House...: "Camping, Housing, Dwelling"

The final individual studio project in the 2A design studio requires a full integration of conceptual design, program, zoning, structure, and materiality. The project involves the design of a multiple dwelling building to be set on existing sites in the urban fabric of the adjacent city. The individual units of the dwelling building are to be based on the architectonic structure developed in the first project of the term, contingency and the obsession with order, used in repetitive series or subject to a set of topological transformations. This building must make use of the domestic elements designed in stair-window-cabinet (students can use their own "fixture" or select others at a "trade fair" where their models are presented). Students are also required to adhere to a limited version of the local zoning by-law and building code which include parking requirements, setback, height restrictions and the provision of barrier free access to the building.

In addition to a strict set of requirements for the final portfolio submission of the project, students are to create a "key drawing." This drawing should be able to stand alone to describe the conceptual intentions and tactile nature of the project. Students are strongly advised during the first two years NOT to use CAD programs to create or present their designs. Where this technique has become central to some upper year studios, we have found its use in lower studios problematic in its ability to mask poor design concept with impressive graphics and texture mapping.

Building Construction 2: "Term Project"

The second building construction course requirements "piggybacks" "camping, housing, dwelling" with an extension project which is based on the format and requirements of the Concrete Block Competition. The students must complete the detailed constructional and structural design of their residential complex. This investigation is to be presented as a partial "structural axonometric" @ 1:25 scale, a "detailed and labeled 1:10 wall section" and a plan @ 1:50 illustrating framing, spanning and overall dimensions.

Often one of the major preclusions to integrated detailed design lies in a shortage of time for students to tackle all facets with equal rigor. When all aspects are required within the jurisdiction of one course, students can gloss over certain aspects or requirements without a major impact on their final evaluation. This project provides for dedicated time and credit weighting to be devoted to the tactile and the technical — allowing for an in-depth investigation.

Towards the Eventual Brick House Studio...

In the context of the Stick House Curriculum, it is ultimately exhilarating to see students create an architecture that not only grasps issues of design and technology, but integrates these issues in such a vital manner as to achieve excellence and maturity in their approach to design. ...to laugh in the face of the Big Bad Wolf because they have not only learned how to handle his tactics, but handle them with true knowledge and finesse. Inclusion of bio-climatic considerations in conceptual design and the move towards complete passive and sustainable design, will lead to the eventual evolution of the Brick House approach to the curriculum.

At the present time, I feel that we have surpassed the design trappings of the "Straw House" attitude, and developed a successful "Stick House" pedagogy and curriculum. The design studio maintains a high conceptual design focus which is not compromised by including the technical, but rather, enhanced. The "Brick House Studio" is under development. The first and second year technology curriculum is being revised to more proactively address issues of climate, sustainability and passive design. A third year level course is now offered which addresses the detailed conceptual design issues of passive and sustainable design and their integrated application to architectural design projects. The potential engendered by the eventual implementation of the ideology of the third little pig is captivating...

So... Blow away because... "Who's afraid of the big bad wolf?"

NOTES

1 Boake, Terri Meyer. "Intrinsically Linked: Conceptual Design and the Materiality of Structure." Conference Proceedings. 12th National Conference on the Beginning Design Student. Virginia Tech, 1995.

2 This project was written by Rick Andrighetti who coordinates the first year studio at the University of Waterloo.

3 Winter 1996 will mark the third year that this event has been possible through the generosity of the Ontario Masonry Association. Students work with masonry apprentices in their training facility.

4 This project was initiated by Donald McKay and is now conducted by Steven Mannell as coordinator of the second year studio during the fall term.

5 This project was initiated by Donald McKay and is now conducted by Steven Mannell as coordinator of the second year studio during the Fall term. The object parameters have included Hearth (kitchen), Well (bathroom), Secretary, Stair, Wardrobe, and Zinc.

6 This project was written by Donald McKay as part of the first year studio at the University of Waterloo.

7 This project has been monitored by myself in conjunction with the generosity of the Ontario Concrete Block Association and is in its eighth year.

8 This project was created by the author and has been run for three years. The parameters have been expanded to include the calculations of thermal resistance values for the comparative sections in order to highlight any performance increases achieved by the student designs.

9 This design studio portion of this project was initiated by Donald McKay and is now conducted by Steven Mannell as coordinator of the second year studio during the fall term. The technology portion of the project is under my direction, and for scheduling reasons, is submitted after final reviews for the studio portion of the project. This permits students to incorporate changes and further research the structural and material requirements for the buildings.