

**AC 2008-720: DITCHING DIGITAL: THE BUILDING OF PHYSICAL  
MINIATURES**

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# **Ditching Digital: The Building of Physical Miniatures**

## **Abstract**

Scaled models are often used by architects and engineers to study the structural behavior of buildings or the reaction of buildings subject to natural forces such as wind or fire. Currently these models tend to be created through the use of sophisticated 3D software to acquire the accuracy that is demanded in engineering computations. Similarly, computer generated 3D models are also often used to study architectural concepts and the interplay of color, form and light: the standard tools of every architect.

This study into architectural technical education looks at the use of scaled physical miniatures (hand built models) to study the relationships between buildings systems and interior architecture. Through the use of survey methodology, it explores questions about the value of scaled miniatures primarily in comparison to their popular, computer generated partners. More specifically, this study assesses student perception of their value and also examines the usefulness of scaled miniatures upon the learning of craftsmanship, selection of materials, presentation techniques and the correct juxtaposition of building elements within building assemblies that are required to house interior building systems.

This proof of concept study is set within the context of an undergraduate course and the limited amount of literature on this specific topic. It examines and assesses student responses to the survey and projects the results into a setting for more rigorous, future research within this topical subject area.

## **Introduction**

It is quite common in the context of today's architectural education to witness students studying computer models of their design projects to analyze items such as proportion, solar gain, daylighting and structural failures. The use of these models and modeling tools is prevalent, as the computer performs these tasks well and accurately and does so in a rapid manner that a student laden with numerous deadlines can appreciate.

This paper questions the value of models that are not computer generated but, instead, are hand-built constructions. In the wake of the overload of computer imagery is there still value in creating scaled miniatures of design projects? Do students perceive that non-computer generated models have some value in their education when they are immersed in an electronic design environment? What value do these models really hold? What do they learn the most in working on

these types of models as compared to computer images? Do they feel that they learn more than what they could learn on a computer?

In an education setting that is often caught up in chasing the latest and greatest software products, these become important and valid questions in designing curricula for architectural technology and interior design programs. In an effort to answer these questions, this study reviewed the process of model building within a course that focuses upon interior building systems. This paper explores this journey and attempts to find the answers to the questions posed above.

### **Literature Review**

The literature on hand-built architectural scale models falls mostly into the category of how-to references such as the work by Sutherland<sup>1</sup> that are essentially overviews of the craft for students of design or anyone interested in making the large small. These have been in the tool boxes of designers for ages and the long, historical list of this type of resource attests to this<sup>2,3</sup>. Their main forte is in their ability to speak to the materiality of the models and craftsmanship as well as to display the models of other students and professionals. They also address model typologies and their levels of abstraction or detail as they find their place in the design continuum (e.g., Schilling)<sup>4</sup>. This guides the students to creating artful models and ones that are aesthetically pleasing, as noted by Busch<sup>5</sup>. These often diverge into resources that speak to how hobbyists or professionals can construct doll houses or to reference sources that discuss the making of “toy houses”<sup>6</sup>. Similarly, there are many references made to models and presentation techniques and how making miniatures supplement the skill sets of budding designers keen to impress the level of their design skills upon their teachers or clients. These sources attest to the overarching use of models in design education, yet they often do not speak to the value of hand-built models in comparison to computer models, nor do many of them couch their discourse in a discussion of using models to teach particular concepts that computer models may not be proficient at.

There are also many sources that speak to models that assess and address the structural capabilities of construction techniques or ones that are used to assess daylighting and wind forces.<sup>7</sup> In this manner, the models are being used to address technical problems in design and achieve many results that can now be replicated by computer simulations. It is not the intent, however, of this paper to discuss these types of models in any detail.

It is refreshing to note that there are several recent publications that address more in-depth concepts of model making and take the literature in this genre to new

levels. An example of this is the writings of Albert Smith<sup>8</sup> whose recent work looks at the history of model making from Egypt to Medieval and Renaissance models and is noted as being one of the first authors to question the why and how of architects' use of scale models.

Author Karen Moon<sup>9</sup> also discusses the meaning of models for designers, the relationship between models and actual buildings, and the impact of scale. She also explores how architects use models for presentation and the creation of public image. In addition, she focuses on the practice of model making: the relationship between the architect and the maker, the materials and new technologies that are transforming model making. This book sets the groundwork for an intellectual discourse on model making that has been lacking in the other, craft-orientated sources.

Mark Morris<sup>10</sup> explores the scale model on similar grounds. He looks at how the development of digital fabrication devices has made model manufacture even more pervasive. He makes mention that “the physical model is the most accessible form of architectural communication. Clients and the general public seem to immediately respond to and understand the model, over blueprints and computer simulations.” He also goes on to discuss the use of models in presentations and notes that “we are now at an important watershed for the model in architecture. Practitioners and educators alike are seeking to fully understand the multiplicity of model types and how they might be strategically deployed at appropriate stages in the design process.”

His comments bode well for the type of examination conducted herein. There is obviously a shortage of discussion directed at the use of scale models and education and little discourse that originates from the students. This project sets out to explore this and to add to the discussion in this area of architectural education and to set the stage for more rigorous research experiments.

## **Methodology**

The intent of this study was to probe the surface of this topic in order to establish a research direction on model making. Therefore, along with the above literature study, the author used two methods to gain answers to the questions posed at the beginning of this paper.

At the outset, a review was conducted of the top undergraduate architectural schools in the United States to determine if hand-built models were being utilized as design and teaching tools. The rankings of architecture schools by the Design

Futures Council was used to determine which schools to review<sup>11</sup>. In total, 10 school web sites were reviewed:

Virginia Polytechnical Institute and State University, Cornell, Syracuse, California Polytech State University, University of Cincinnati, University of Texas at Austin, Carnegie Mellon, Kansas State, Pennsylvania State, and Pratt Institute.

In each institution, scale model building was being used by the students to complete their projects and in many instances scaled miniatures were being used extensively. This attests to their popularity as a medium of design exploration in an era when the computer and its software can accomplish similar tasks. Despite the proliferation of electronic media, these top rated schools still see model building as an essential skill set in the tool box of architectural students.

The second method of discovery was a questionnaire directed at students in an undergraduate course in Interior Building Systems at Indiana University Purdue University Indianapolis (IUPUI). These students, in the third year of their design program, are required to work with hand built scaled miniatures in exploring the design of numerous interior building systems (e.g., walls, ceilings, floors, plumbing, HVAC). Prior to entry into this course, all students were required to take a minimum of three courses that focused upon the development of three dimensional computer models of buildings and interiors. As well, many of the students had been exposed to a virtual CAVE (Cave Automated Virtual Environment) where, with the aid of special glasses, students can “walk” through the designs they have created. In short, prior to this class, they have had numerous experiences designing and exploring three dimensional computer generated environments.

The Interior Building Systems course is only offered once a year and this was the second time it had been offered, so the students had the opportunity of seeing the work of previous students. The first students had noted that the use of models was very helpful in learning about interior building systems, so this second class provided an opportune setting to test these comments. Furthermore, all of the current students had taken courses that required scaled hand built model building, so this was not a new experience for them. However, their experience with building these types of models was limited.

The questionnaire was handed out to the students following their first assignment requiring them to build a sectional wall assembly using a scale model. Students

had to select the model materials for the assembly and were all told to limit the base of the model to 8 ½” to 11” x ½” thick. They were also instructed to produce a monochromatic model (that could also use black and white) to reduce the focus upon color and to have them concentrate on the material assembly. They were also told that the model must exemplify the “art” of model making and that it must be suitable to bring to a boardroom discussion. In other words, the model was to be a presentation model of a wall assembly and it had to be professionally crafted (see Figures 1 and 2).

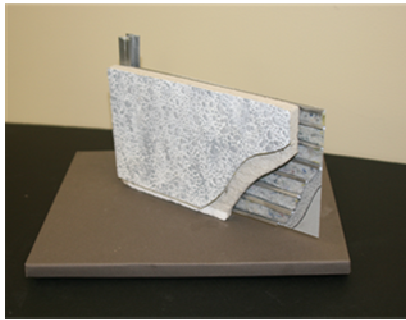


Figure 1- Wall Assembly Model 1

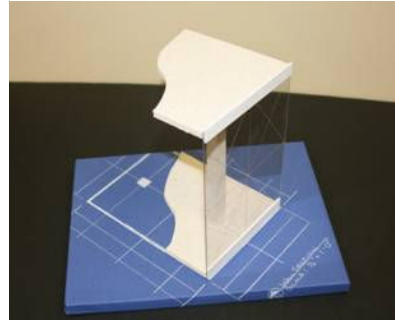


Figure 2- Wall Assembly Model 2

All of the students in this small class participated in the questionnaire. Responses were anonymous and the instructor was not aware of the author of each paper. The questionnaire was also not a required responsibility of the students, nor did they receive a grade. They were told that the instructor simply wanted feedback on the value of this teaching tool. They were all given 10 minutes to complete the assignment.

There were four questions on the survey in order to keep the data focused upon the research questions and as this project was solely being used to pilot and probe this research topic. All questions were of a closed format and were as follows:

1. I have learned a lot by completing this model

Totally Disagree  Disagree Somewhat  Agree Somewhat

Agree  Totally Agree

2. I have learned a lot about the construction of this assembly by building this model than if I would have made a similar, 3-D model on the computer.

Totally Disagree  Disagree Somewhat  Agree Somewhat   
Agree  Totally Agree

3. I have learned the most about (select what you feel is the most important...one box only).

Model Building  Construction Materials  Material Order

Material Selection  Craftsmanship

4. I am a:

Senior  Junior  Sophomore  Freshman

### Results and Discussion

There were a total of 11 students that participated in the questionnaire. All but two were seniors in their design program. The data collected can be found in Table 1.

One can see from these results that all students either agreed or totally agreed that they learned a lot by completing the model. As well, all of them agreed that they learned more about the construction of this assembly than if they had made a similar model on a computer. In this instance there were five of them that somewhat agreed, yet there were none that disagreed. They all agreed to some extent that this type of model construction was valuable.

Five of them also stated that they learned the most about model building from this activity. The other response noted was that they learned a mixture of knowledge about materials, with one participant noting that they learned the most about craftsmanship. In other words, by completing this model, five of them learned the most about constructing a model versus learning about interior wall assemblies. From these participants, one could surmise that the activity had more to do with the act of model building than it did with the understanding of materials, whether it was material selection or the correct ordering of them. The act of building the

model was obviously challenging and consumed a lot of their learning (and time). Yet as these results represent only less than a half of the group, it is difficult to reach any type of decisive conclusion as to how this experience affected them the most. Either they learned a lot about model building or they learned about the architectural wall assembly.

Table 1: Results of Questionnaire

| <b>Participant Number</b> | <b>Question One</b> | <b>Question Two</b> | <b>Question Three</b>  | <b>Question Four</b> |
|---------------------------|---------------------|---------------------|------------------------|----------------------|
| 1                         | Totally Agree       | Agree Somewhat      | Material Order         | Senior               |
| 2                         | Agree               | Agree Somewhat      | Material Selection     | Senior               |
| 3                         | Totally Agree       | Totally Agree       | Model Building         | Senior               |
| 4                         | Totally Agree       | Totally Agree       | Material Order         | Junior               |
| 5                         | Agree               | Agree               | Construction Materials | Senior               |
| 6                         | Totally Agree       | Agree Somewhat      | Craftsmanship          | Senior               |
| 7                         | Totally Agree       | Totally Agree       | Model Building         | Senior               |
| 8                         | Totally Agree       | Totally Agree       | Model Building         | Senior               |
| 9                         | Agree               | Agree Somewhat      | Model Building         | Senior               |
| 10                        | Agree               | Totally Agree       | Model Building         | Junior               |
| 11                        | Agree               | Agree Somewhat      | Construction Materials | Senior               |

### **Summary and Recommendations for the Future**

The sample group used here was small and it is difficult, if not impossible, to make widespread conclusions beyond this, yet the study itself is a useful guideline for future studies about model making. All of the data displayed should also be reviewed in light of the fact that it took place in a classroom and that the students may have cast their answers in a favorable light in order to support the teacher's pedagogy. This can be overcome with more longitudinal studies.



Of importance in this preliminary study into this research topic is that one can see that manual model making is not a traditional skill that is being overlooked, despite the prevalence of digital models. Both the prevalence of top architectural school usage and the comments made by these students agree that it does have importance and value in the contemporary curricula of design schools in this country. It still remains to be seen exactly what value these models really have. Do they merely only teach model building expertise or do they have value in the learning of architectural concepts in light of the competition that they face from computer models?

It has been seen through this preliminary study that these hand built model miniatures are worthy of this type of review. Further studies such as this will help to unravel the complexity of this interesting topic and debate. Rigorous, experimental research is required to reach compelling conclusions. It should be kept in mind that this paper addresses a proof of concept test only.

Is ditching digital really sensible? Only this can be answered by a more detailed overview of this topical area of architectural education. It is certainly a debate that should be explored.

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