

# Computer **Modeling** and **Visualization**

using **form•Z**

## in a Basic **Design Curriculum**

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### Introduction

This article discusses a pedagogical approach to computer modeling and visualization in an Interior design program's foundation curriculum using form•Z. Widely known as solid modeler based on a Cartesian coordinate system with extensive sets of two-dimensional and three-dimensional form sculpting and manipulating capabilities, form•Z by AutoDesSys Inc. has both solid and surface modeling tools combined in the same environment, thus allowing the creation of unlimited forms. These properties make the software suitable for teaching basic design to foundation students.

Form•Z and computer modeling courses are generally integrated at the University of Oklahoma Interior design curriculum as required and elective courses or in studio based courses. The projects discussed here illustrate form•Z's unique interface, which fosters the ability to design volumetrically, to model spaces, and to simulate photorealistic rendering in a freshman studio. Anderson's ACT-R theory is utilized to guide students through the software learning process. ACT-R theory focuses on three stages of skill acquisition: cognitive, associative, and autonomous stages. These three stages present several implications for teaching form•Z to Interior Design students.

### Process

ACT-R (Adaptive Control of Thought—Rational) was developed by John Robert Anderson at Carnegie Mellon University. The basic premise is that the cognitive tasks that humans perform consist of a series of sepa-

rate actions and procedures. ACT-R's main assumption is that knowledge can be classified as declarative and procedural. Declarative knowledge is factual knowledge, while procedural knowledge is how to perform cognitive tasks. According to Anderson, procedural knowledge is acquired in three stages of skill development: cognitive, associative, and autonomous. The cognitive stage represents the phase in which "subjects develop a declarative encoding of the skill; that is, they commit to memory a set of facts relevant to the skill" (Anderson, p. 273). The associative stage results out of repeated practice, as a result of which performance becomes smoother and more rapid, thus leading to proceduralization. As the procedure becomes more automated through practice, the autonomous stage emerges.

There are four major applications of Anderson's ACT-R to teaching form•Z discussed in this article. First, students develop an accurate and elaborate declarative representation of the desired procedures (actions) and conditions of using form•Z. Second, teaching can be accomplished using the expository (teacher-centered instruction) and discovery methods. The aforementioned first two steps are accomplished through teaching students concepts such as modeling basics and the software interface; topological modifiers; geometric transformation; terrain modeling; image and texture maps; cone of vision; and rendering and presentation techniques. Hands on lecture demonstrations are used to accomplish the topics mentioned. Students also learn through discovery. In studio and outside of studio, design and modeling of a residence and bus stop

Task	Process
Develop accurate and elaborate declarative representation of Form.Z	<p>Examples of concepts covered to help students develop an accurate and elaborate representation of Form.Z are the following:</p> <ul style="list-style-type: none"> <li>• Modeling basics and software interface using quick 5 minute vignettes</li> <li>• Topological modifiers</li> <li>• Geometric transformation</li> <li>• Terrain modeling</li> <li>• Image and Texture Maps</li> <li>• Cone of Vision</li> <li>• Textures</li> <li>• Rendering and presentation techniques: Wireframe, Surface Rendering, Shaded Rendering, and Renderzone</li> </ul>
Expository Methods (Teacher centered instruction)	Using the expository methods involves teacher centered instruction to help students develop declarative knowledge. The above listed topics are presented in hands on lecture demonstrations to students, and students follow along and then create their own models.
Discovery Methods	The discovery method allows students to learn through discovery. In studio and outside of studio modeling of Bus Stop and Kravet projects help students practice the concepts learned on their own design projects.
Feedback Component	Feedback is an important component, because it fosters proceduralization. Any misconceptions and disequilibrium are fixed with feedback.
Automatization	Continued practice leads to automatization and this will be evident in the curriculum and the complexity developed in the quality of the student work.

Table 1: Anderson's ACT-R general implications for teaching form•Z.

project help students practice the concepts learned on their own projects. Third, feedback is an important component to foster proceduralization, to fix any disequilibrium, and to ensure that students understand the concepts. Finally, emphasis on continued practice leads to automatization, in which students become more competent with the software. The goal is for students to become more competent as they proceed to upper level studios.

The accompanying chart (Table 1) summarizes the application of ACT-R theory to teaching form•Z. Students are taught accurate and elaborate declarative principles of form•Z in order to help them understand the interface. Learning is achieved through exposition (teacher centered instruction to help students develop declarative knowledge) and discovery (student inter-

nally focused) methods. Constant feedback is given during the learning process to correct any disequilibrium students may have. Eventually, students achieve automaticity due to continued practice.

### Case Studies from Design and Graphics Studio

The following two case studies illustrate experiences from Design and Graphics studio, a freshman Interior design course. The studio focuses on introducing students to basic design principles and techniques of representation and communication used in design. This is the first drawing class for this group of students. Students explore small scale spatial problem solving. After using expository methodologies through several hands on in class demonstrations focused at helping students develop declarative knowledge about form•Z, students



Figure 1: Kravet Room Design project by Heidi Kunsman in ID 1254 Design and Graphics II, Spring 2010.

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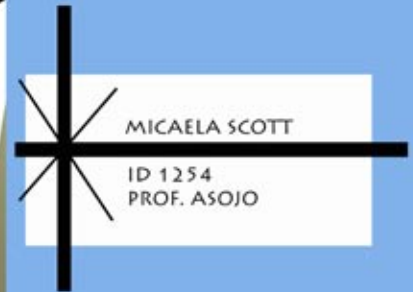
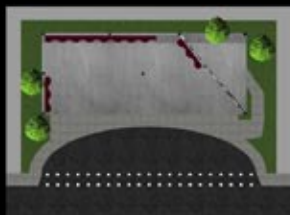


Figure 2: Kravet Room Design project by Michaela Scott in ID 1254 Design and Graphics II, Spring 2010.

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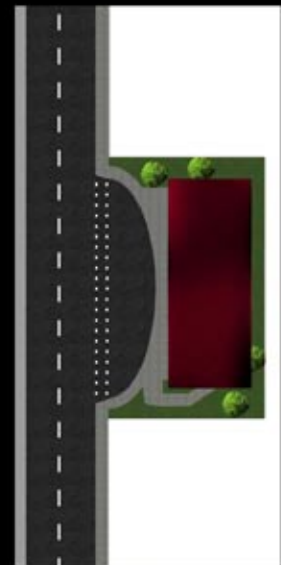
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Figure 3: London Bus stop project by Maggie Dusing in ID 1254 Design and Graphics II, Spring 2010.

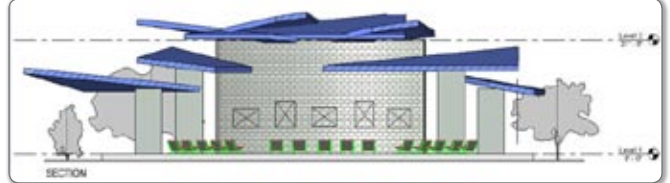
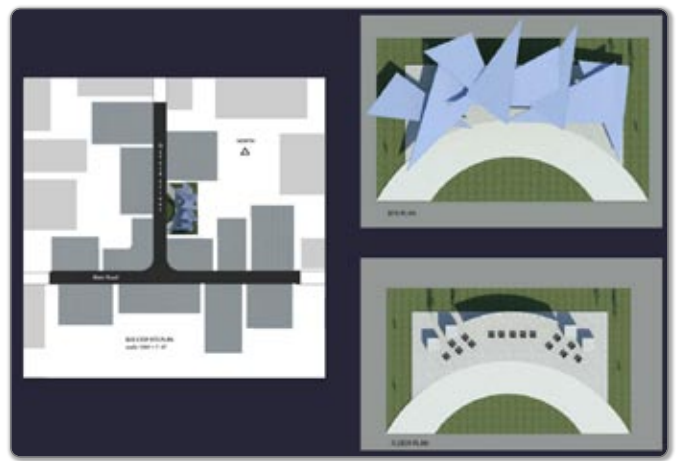
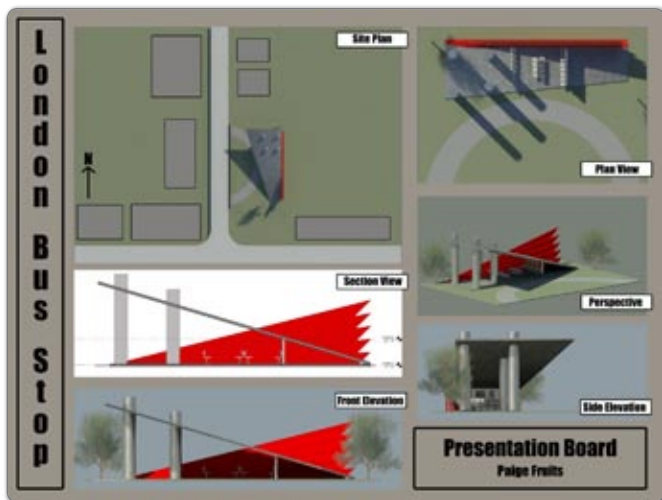
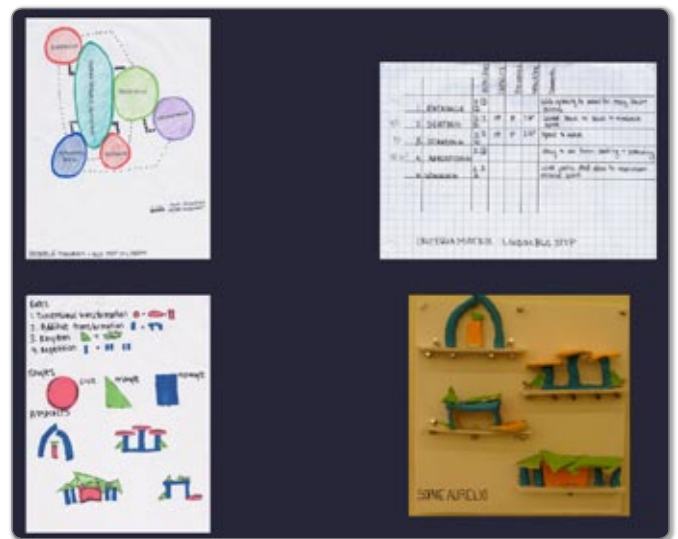
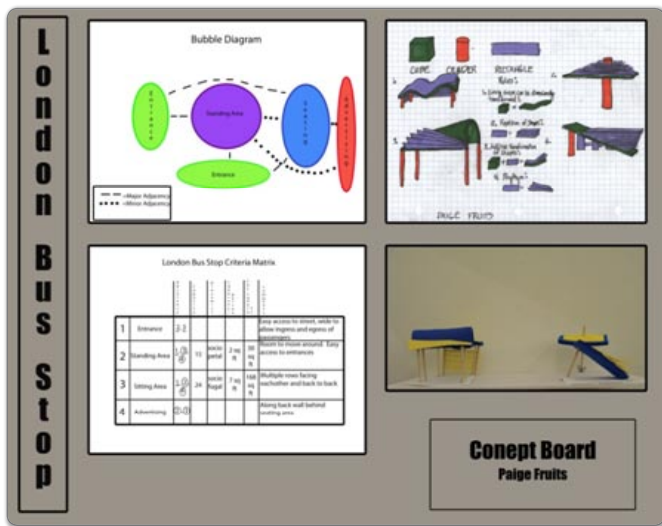


Figure 4: London Bus stop project by Paige Fruits in ID 1254 Design and Graphics II, Spring 2010.

Figure 5: London Bus stop project by Sophia Aurelio in ID 1254 Design and Graphics II, Spring 2010.

are assigned two four week design studio projects. In the first project, students design a room in residence as part of the Kravet student competition. Figure 1 and 2 illustrate room design solutions using form•Z. In the second project, students design a bus stop in London using shape grammar principles. Students begin by creating basic geometric shapes. Then, they develop rules between the shapes using design elements and principles. Next, they develop abstract model and select one to be transformed to their bus stop design. form•Z is used throughout the design process to represent their design solutions. Figure 3, 4, 5, and 6 illustrate bus stop design solutions modeled using form•Z.

Micaela Scott  
Final Project  
Prof. Asojo

BUS STOP  
IN LONDON

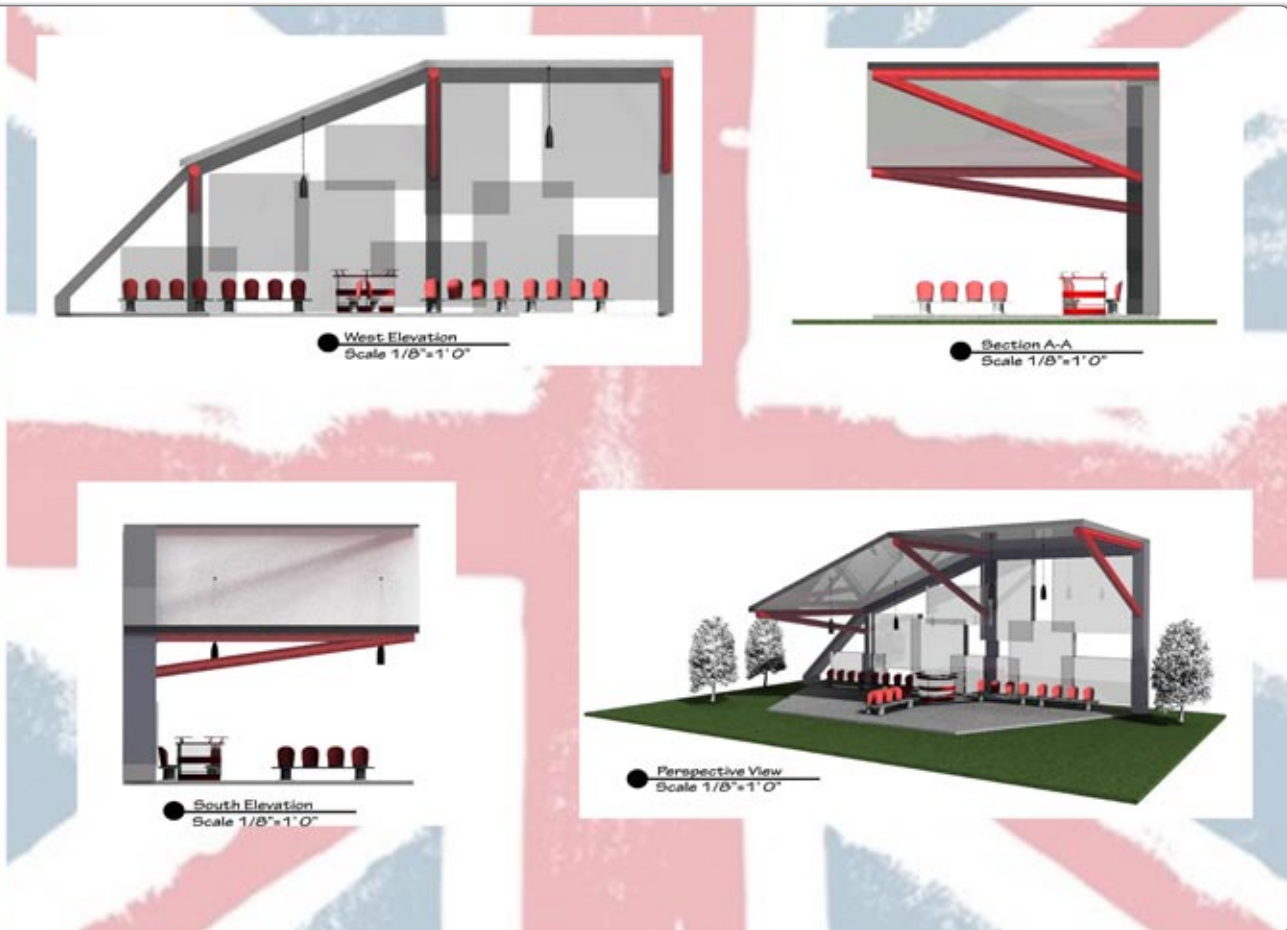


Figure 6: London Bus stop project by Michaela Scott in ID 1254 Design and Graphics II, Spring 2010

## Conclusion

Overall, the projects presented here illustrate form•Z's unique interface while combined with Anderson's ACT-R theory's three stages of skill acquisition (cognitive, associative, and autonomous) can foster the ability to design volumetrically, model spaces, and simulate photorealistic rendering in a freshman studio. Through pedagogical examples, like this interior design, educators can integrate form•Z fundamentals in the freshman interior design curriculum, thus promoting software that facilitates computer modeling presentation techniques in visualizing form and presenting design solutions.

## References

- Anderson, J.R. (1990). *The Adaptive Character of Thought*. Hillsdale, NJ: Erlbaum.
- Anderson, J.R. (1995). *Cognitive Psychology and its Implications*. New York: Freeman.
- Muir, E.G., Clarke C., and Park N. (1999) *Inside form•Z*. United Kingdom: OnWord Press
- Asojo, A. O. "Computer Modeling and Visualization using Form.Z in Interior Design Curriculum" 2005 Interior Design Educators Council Conference Southwest Regional Conference, Shreveport, Louisiana October 2005.



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