Chapter XIV
An Integrative Approach to Teaching 3D Modelling in Architecture

Carmina Sánchez-del-Valle
Hampton University, USA

ABSTRACT

The argument presented here is that computer courses must reach beyond the comfortable cushion of conventional teaching practices, and provide students with a way to come to grips with complexity. It provides as evidence a digital graphics literacy course for architecture students using transformer robot toys as a metaphor for introducing the concept of adaptive kinetic architecture. The transformer toy provides a manipulative device with which to develop students' 3D modelling and rendering skills. The course approach is described, and observations about the students' work are offered. It concludes further investigation is needed to ascertain the most appropriate delivery for reciprocal and complementary knowledge. Years ago during a summer vacation, I watched my four-year old nephew play with his favorite toy—a transforming robot composed of smaller robots. A transformer robot is a highly articulated figure with specialized joints that allows form to change without disassembly. The joints are simple mechanisms, and transformation depends on a highly orchestrated sequence of moves. My nephew, who was bilingual and illiterate then, focused all of his attention on the five figures in front of him, and one-by-one reshaped them to build the larger robot. His eyebrows were tense; his eyes followed the actions of his hands, and his fingers moved gingerly and precisely over the moving parts. He would not speak until the five would be reconfigured into one large robot. He had simpler transformers that could change from vehicle or animal to robot, and he had mastered them all. Instructions for manipulating the toy are primarily graphical; they use line, color, shades, and arrows to indicate how a part is to be rotated, sledded, pushed, or pulled. I noticed, however, that my nephew never used them to pursue his hands-on studies. I realized then that the transformer robot toy was the vehicle I had searched for that would introduce my students to the modelling of complex geometries and articulations in a way that would cross over to other courses in the curriculum, in particular the design studio.

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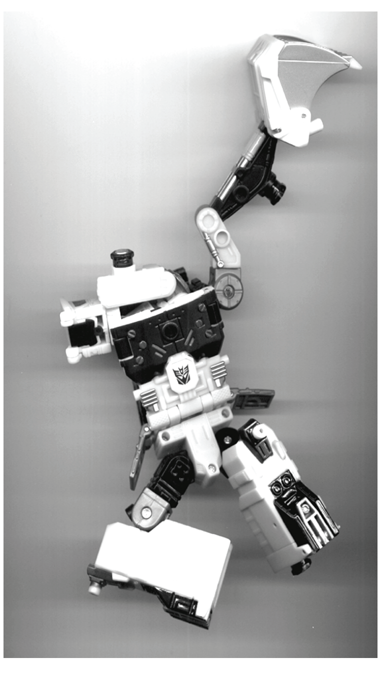
INTRODUCTION

For years I had observed architectural students struggle to grasp concepts and master various commercial off-the-shelf modelling and graphic software in a range of elective computer courses I had developed. The courses guided students into developing their two-dimensional (2D) and three-dimensional (3D) visualization skills through a series of small playful design problems, drawing and constructing models with computer-based tools. These problems encouraged the exploration of various software package capabilities to address the challenges offered by the designs. The idea was to have each student build his or her own approach to thinking about digital representation, and *computer aided design*, and to develop skills necessary to apply his or her experience in the design studio. I noticed that students would usually utilize what they had learned in the graphic presentation of their design projects, but those same lessons did not carry over to enhance their approach to design. The students were active in resolving the course's projects, but their focus was on developing skills that would make them marketable, not necessarily better thinkers and designers. This was not an exception. Gross (1994) has noted a number of drawbacks associated to *computer aided design* literacy courses in architecture schools, among them a "false sense of achievement" (p. 57), having conquered the difficulties posed by a software package rather than a critical attitude toward design computing.

Figure 1. Transformer robot toy in the process of change; Hasbro® Energon toy



I decided to investigate with my students a different way to teach about modelling and rendering with the computer. Modelling is used in this context as the building of 3D models, and rendering refers to the painterly manner in which images of the model are further developed to approximate reality. The approach would challenge the students' imaginations and analytical skills. It would require them to question the nature of architecture as they stretched the limits of the software; this would still allow them to meet the fundamental goal of building their computer-based representation skills. It was about initiating change in students' design frameworks so that they could understand the requirements, the nuances, and the possibilities for dealing with the complexity of the world's design challenges. Also, it was important to make a definite connection with the process of design and the applicability of the tools so that the knowledge would be realized as reciprocal and complementary, and would be transferred into studio in a more meaningful way crossing over the existing curricular barriers. A shift from a computer-oriented to content-based model with an architectural design focus—a studio-like environment instead of a lecture and workshop where students complete a series of prescribed visualization exercises—was seen as a way to resolve the gap between support course and studio. The studio-like format also facilitated peer-to-peer learning, a solution to another challenge: a group of students with varying design skill proficiency and levels of experience working with

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