Tools and Technique

by Jay David Stauffer

Tools: anything used as a means of accomplishing a task or purpose.
Technique: technical skill; ability to apply procedures or methods so as to affect a desired result.

Although the emphasis in the language of architecture school was never on the tool, but on the technique, architecture school proved to be an introduction to all sorts of fascinating tools (parallel rule, tech pen, compass, mechanical pencil, computer). As we set out to learn to analyze/ document architecture through material construction (model) it was mentioned that "sometimes you need to make your own tools". For example, we learned to make a woodcut to punch windows into a clay model. In another experience, I found that I could use the band saw to cut a jig to help guide the lathe to make a sphere. It sounds convoluted, but this is using a tool (band saw) to make another tool (jig) to reach the intended outcome (the sphere, see Figure 1). The band saw by itself can not mill a sphere because it does not easily create forms that are radially organized. It is two and a half dimensional. The lathe makes every input into something radially organized, but the sphere is a very specific shape requiring input to be thoughtfully guided and measured. The solution layers multiple tools to overcome the lack of specificity of a single tool, constraining the latter tool while empowering the user. And that is where we want all students to be with whatever design tools they use.

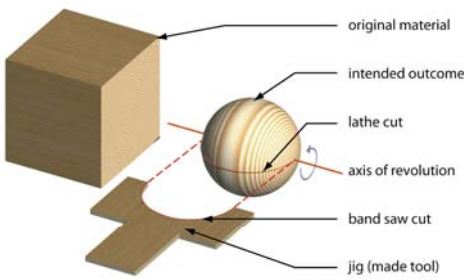

Figure 1: **Sphere illustration.**

Teaching Digital Design Tools

Most people struggle with their initial encounter with digital design tools. The question is where and how to start. It seems that too many students abandon perfectly good analog techniques when faced with the seemingly new digital tools. The computer lends itself to the perception that there is a right input and a right tool to select to get directly to your intended outcome. This is neither the nature of tools or design. Like the problem of making a sphere with physical tools, no single digital design tool fits the vision precisely. It lacks that kind of individual specificity. This perception is also intimidating because "close doesn't count". Getting close to the intended outcome with a sketch and then refining later is precluded. Furthermore, mastery of the software tools is reduced to memorization. What is left when the tools are considered to be new and the techniques have been abandoned, is the paralyzing fear of the blank page.

This fear of the blank page can be mitigated by teaching every tool as a concept or analogy. In my first year of teaching at the Boston Architectural College, I set out to teach the **form•Z** tools along with the concepts behind them. I teach the tools in the tool palette as analogous [sic] to analog tools. For example; the Revolve tool is like a lathe and makes radial objects, and the Section tool is like a band saw that can be used on the whole model. Other tools have similar techniques instead of being analogous to physical tools. The concept and story behind Primitives is the lesson from figure drawing that complex shapes can be closely approximated from simple geometry: the palm of a hand is a square, the fingers are divided at the knuckles into rectangles, a head and eyes are ovals, and a nose is a triangle. If the digital tools and methods are analogous to something already known, the student should already have a method for working and thinking. A student who knows how to sketch already has a way of processing complex objects and a student who knows how to draft does not need to abandon the use of construction lines as a way to regulate, position or otherwise facilitate working in 3D space.

Second Order Technique

With an understanding of the tools and techniques restored, the student can begin to go beyond the limits of any single tool and begin to both use tools and to make other tools. Sanford Kwinter in the Afterword to Tooling [Pamphlet Architecture] explains that "*one needs cranes not only to create edifices, but also to build larger cranes without which one cannot create the greater and more demanding edifices*." This "second-order" thinking can be applied to our software tools to become a technique where multiple tools are combined.

It is a characteristic of the **form•Z** tools that they are general purpose. They require thoughtful input from another tool. Therefore the infinite variety and power of **form•Z** is in combining or layering of multiple tools. Like the example of making a jig to make a sphere, or using a crane to make a bigger crane, a source form must be made with another tool before the Derivative tools can be used and more complex shapes generated. The mutability and facility to duplicate and modify digital form makes every object on screen a potential tool. Every object in **form•Z** can be thought of as having two un-exclusive paths. We determined that it should be thought of as an object for further refinement but it can also be thought of as a tool to refine another object.

In a simple example, the roof object is both the roof object and the jig for differencing the walls. Or as is the case with the work featured and explained below, a primitive is sectioned to derive a source shape which is modified and used for a C-mesh to create any variety of more complex forms. The complex form can be deconstructed into more source shapes and the process continued. By working this way, we leverage the mutability that is characteristic of digital design tools in a manner free from the constraints of any single tool. What this means for teaching is that it is not simply enough to demonstrate the functions of the digital tools, but to teach the students the concepts and analogies and make them aware of the power of the second-order thinking of combining **form•Z** tools.

Introduction to the Work

The **form•Z** project featured is the work of **Leslie Evans** and was completed during the summer session at the Boston Architectural College. The class is eight weeks long and consists of two projects. The first project, due at mid-term on the fifth week, is intended to allow students to get comfortable with the software by creating an interior scene from their imagination. The remaining three weeks are spent on the final project to present a known object. The subject is suggested to be a local building for the Architecture students, but students with other backgrounds are encouraged to work with subjects pertinent to their field of study. I believe this project exemplifies a combination of instruction in the tools and concepts along with second-order thinking. It is also an example of a lot of hard work and a mind that needed to create the way that **form•Z** works. Here is how the project progressed in Leslie Evans' own words.

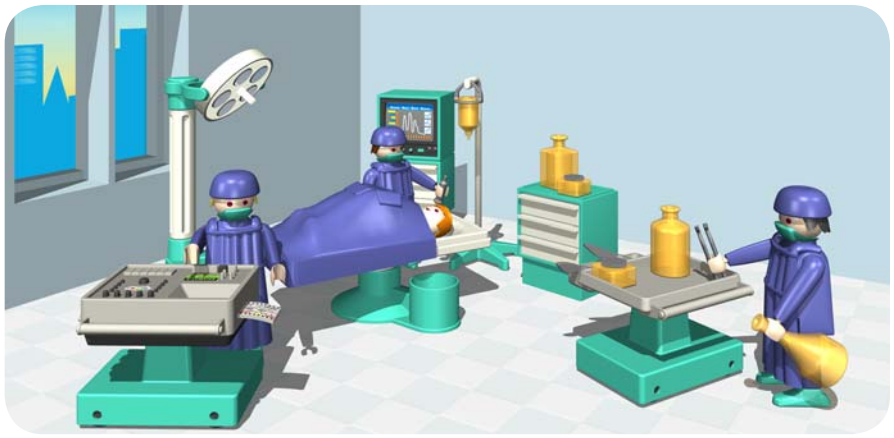

Figure 2: **Scene.**

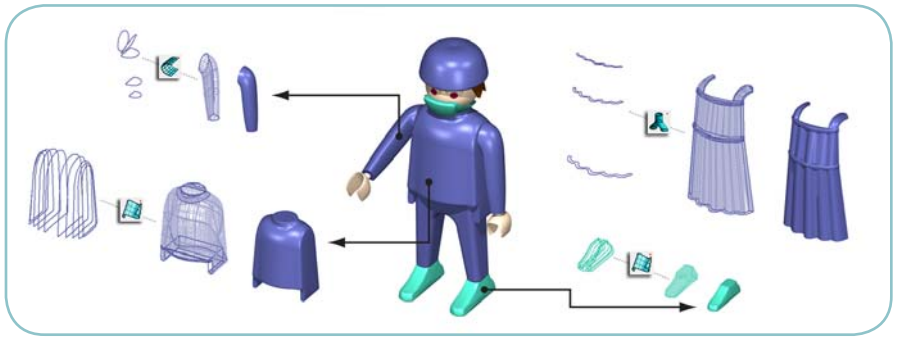

Figure 3: **Figure.**

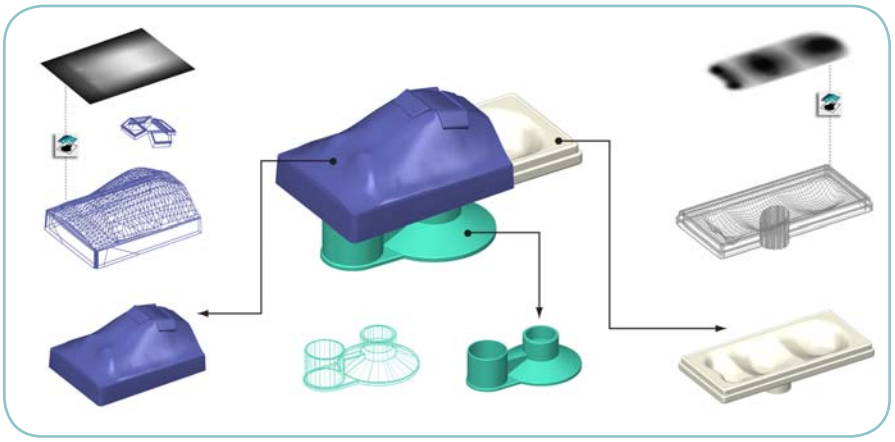

Figure 4: **Bed.**

The Work

When the class was given our second (and final) major assignment of the semester, to translate an actual building or object into **form•Z**, my mind immediately jumped to toys. The Playmobil® Hospital (see Figure 2) was a perfect choice for my first major **form•Z** modeling effort because the set contained objects of varying complexity. If I was in need of instant gratification, translucent jars could be made simply and quickly using the Revolve tool. More complicated objects like the hospital television and computer required significant time and patience, but still could be constructed using tools I was already comfortable using. The figures and bed proved to be the most challenging aspects of the project, forcing me to expand my **form•Z** skill set and blindly experiment with tools that I had little or no previous experience with.

I initially tried to make the more complicated body parts of the figures by merging together less complicated shapes and rounding the edges. Early attempts at the arms (see Figure 3) entailed using the Union tool to combine a cylinder for the long part of the arm with a sphere for the shoulder. Although these techniques did not produce shapes that accurately represented the real figures, examining the cross sections of these crude body parts, made with the Section tool, provided valuable patterns from which to create source shapes. The body and shoe were constructed from these source shapes using the Nurbz tool, while the arm was created with the C-mesh tool, and the two panels of the apron were created using the Loft tool.

It often tends to happen that once I have some familiarity with a new tool in **form•Z**, I try to use it to make any new object I am trying to construct, even if it is clearly not the best tool for the job. Once I had a basic understanding of using the C-mesh and Nurbz tools, I immediately tried to use them to make the hospital bed. Visualizing cross sections of the bed sheet and operating table proved to be very difficult and I had a hard time making the sheet look like there might actually be a person lying under it.

Luckily, my next **form•Z** class covered the mesh displacement tool, which provided a much easier solution for modeling the bed (see Figure 4). To create the 2-D images for the Mesh Displacement tool I imported an image of my figure into Photoshop as a template and, using a paintbrush with a soft edge, shaded in the indentations the figure would make when lying in a bed. The image for the sheet was made with a similar technique.

There is no doubt that the many hours that I put into the project were a major factor in successfully modeling the hospital set. I'd also like to think, however, that a good mindset for learning a new piece of software can be just as powerful as stubborn determination. I tried to attack learning **form•Z** with the mentality that if I think the software should have a certain functionality, it probably does and I just haven't found it yet. I was amazed at the amount and quality of work that I could produce in **form•Z** after just eight weeks of using the software.

Leslie Evans

Figure 5: **Operation.**

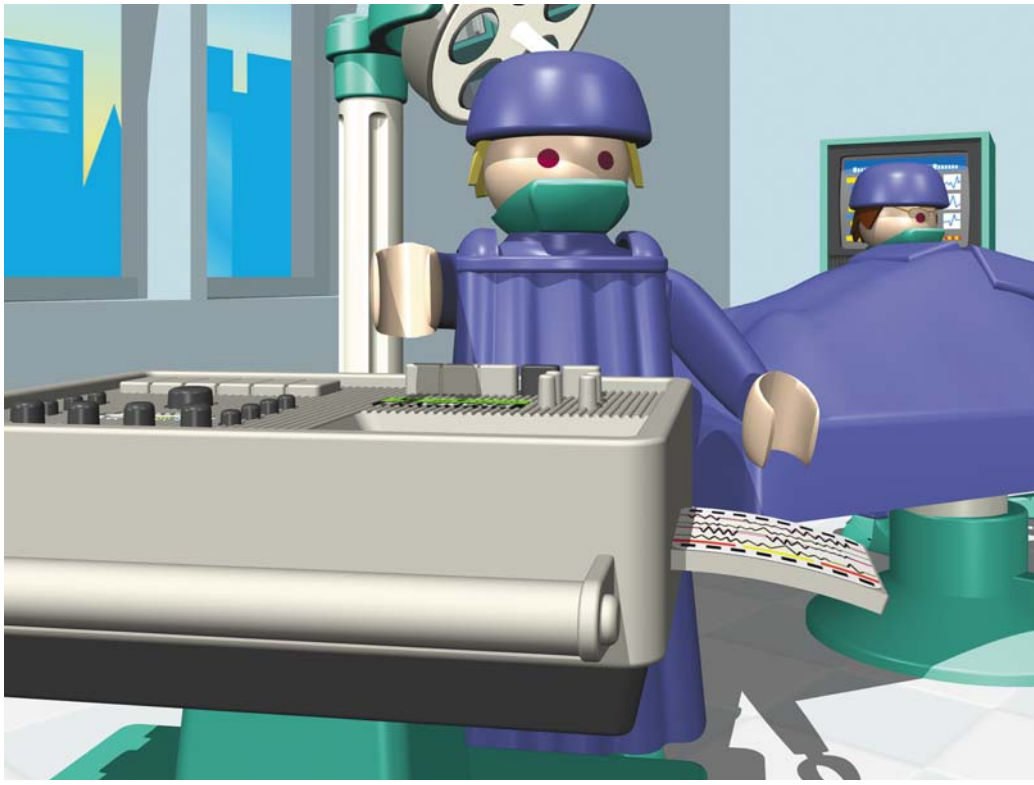

Figure 6: **Computer.**

Jay David Stauffer is the Instructor of **form•Z** at the Boston Architectural College and a Designer at Payette in Boston, MA. His professional work is concentrated on high-tech environments like research laboratories and health care facilities. His current projects include a 260,000 GSF chemistry building for Princeton University. He joined Payette in 2004 as a 3D Visualization Specialist, helping to advance technology's role within the firm while discovering professional techniques to augment teaching at the BAC. In this role he modeled and rendered marketing and schematic design images for many of the firm's projects, and developed an interest in images that show how architecture thinks rather than how it appears. Jay David earned a Bachelor of Architecture from Penn State University in 2004 and also interned with the Master Planning and Urban Design Studio of Walt Disney Imagineering in Orlando, and Office for Planning and Architecture in Harrisburg, PA. Email: jstauffer@payette.com.