Tradition, Tools, Technique & Technology

by Naomi Crellin

The capabilities and possibilities offered by **form•Z** as modeling software are a recent development, opening new doors of opportunity to the furniture maker whose methods of creation are otherwise rooted in tradition. Yet, the traditional methods of making provide us with a vocabulary and set of tools that are the basis of our understanding of modeling. When I began this study, my intent was to compare the similarities of use of tools in **form•Z** with those tools used in woodworking. As I built the study model, I realized that the correlation between tools is more nuanced and the implications are further reaching than a simple comparison of their similar functions in the virtual and physical environments.

The table I recreate for this article is comprised of solid sculpted legs and a bent lamination table top - it was designed and is made by Peter Trumbull Crellin. Prior to commencing studies at RISD in the Masters of Interior Architecture program, I assisted with the making of this and other pieces of furniture – this experience gave me an appreciation for possibility of creating sculptural forms from wood through a number of different processes, methods, tools and with many stages of refinement. I was interested in recreating this table in particular because its form challenges our assumptions of how a table crafted from wood should appear. At RISD a commitment both to the value of making and the value of computing skills, has provided me with the opportunity to move from an analog to a digital mode of representation. Since the start of my studies I have maintained an interest in furniture and as I have acquired 3D computer modeling skills, I have been interested by the similarities of making in the virtual and physical environments. As my ability to model with **form•Z** grew, I was able to envision for the first time digitally modeling a table that is made through sculptural processes of grinding, shaping and pressing or bending in the woodshop.

Figures 1,2: Conditioning and sizing the lumber to create 'billets'.

Figure 3: Leg templates are created in **form•Z** to create the rough leg form.

Tradition: *"A part of culture that is passed from person to person or generation to generation."*

Though developing in the 21st century with the growth of digital technologies, the traditional techniques of woodworking persist as the guiding principles in the making of craft. While **form•Z** provides new methods of modeling, and opens up opportunities for the designer-maker to experiment with material properties, possibilities and perhaps impossibilities, it is these traditional principles of working with wood that have defined many of the terms and approaches used to craft objects and environments in a virtual setting. The tools available to woodworkers, and the manner in which they are used, often shape the end result. This is as true in the virtual world of making as it is the real world of craft.

Figures 4,5: 'Boolean Operations' conducted using the band saw tool in the workshop.

Figure 6: 'Controlled rounding' conducted using the router table.

While the processes used to create a sculptural piece of furniture can be argued to have parallels in the virtual and physical worlds, this simplifies the comparative methods of making: in truth, they are not and cannot be the same. The similarities between our use of tools in the virtual and real making processes are born of our experience of traditional techniques - tradition provides us with the framework and language system we use to understand the basic concepts of making in the digital sense.

Tools: *"Mechanical devices intended to make a task easier"*

In the woodshop, the sculptural process of making is a subtractive one – the furniture maker begins with a raw material and a significant portion of time at the front end of the woodworking process involves conditioning and sizing the lumber to useable dimensions, from which the form is then carved. As designers working in **form•Z**, we have the luxury of specifying the dimensions of our component pieces without this process – in this case I began with my 'billets' sized to the dimensions of the lumber after the initial cutting and conditioning required in the actual making (Figures 1,2).

Leg templates were created, and using the Boolean intersection tool in place of the band saw used in the workshop, the two leg profiles are cut from the solid billet (Figures 3-5). The next stage of shaping in the workshop utilizes an elliptically shaped router bit, rasps, hand filing, grinding and sanding to achieve a smoothed final form. In the virtual environment, this smoothness is achieved through a combination of edge rounding, filleting and meshing to emulate these sculptural stages of the wood working process (Figures 6-8).

Figures 7,8: The rough leg forms are shaped and smoothed in **form•Z**.

The making of the top of the table is in the woodshop achieved through a lamination of layers of veneer over a form, adhered and then pressed in a vacuum bag (Figures 9-12). Achieving this end result in **form•Z** required the meshing of a 1/16" solid to simulate the elasticity of the veneer material. I created a replica of the form used in the workshop and from this defined a profile curve, which was used to move the mesh by pushing it into the desired form. The tabletop thickness was built up in **form•Z** by

Figures 9-11: The veneer pieces are cut using templates, 'stitched' together with veneer tape and formed to a profile using the vacuum press.

placing layer upon layer (Figure 13). The final layer for the tabletop in reality comprises 81 pieces of veneer, hand cut to a checkerboard pattern that in its bent form simulates a draped or melted effect. This design is defined on the flat, unbent lamination layer. In **form•Z** as in the real world templates were created to guide the process of cutting, in this case splitting.

The sculptural process of woodworking is a subtractive one, iterative methods of removing material to create the desired end form. In the virtual process we can use Boolean and other functions to simulate the removal of material, yet if we wanted to experiment, the processes offered up by the software allow us to consider sculptural possibilities that the material of solid wood would not ordinarily permit. We need not be concerned with grain direction or material flaws – just the parameters of the software capabilities for forming and deforming a solid object. So, many of the tools in **form•Z** are analogous to the tools used in the woodshop, but ultimately **form•Z** has the ability to become another tool for the maker.

Figure 12: The layers of veneer that make up the core of the tabletop form are glued and laminated.

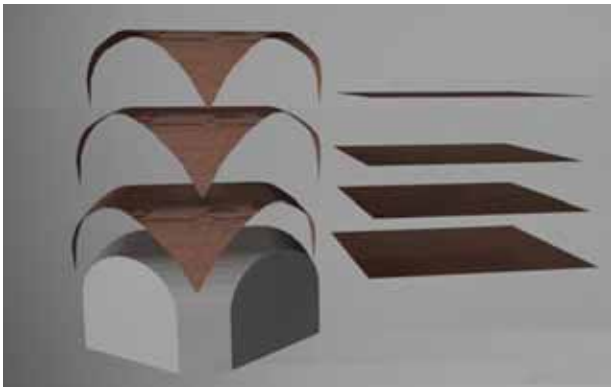

Figure 13: Veneer layers are likewise formed, using the Move Mesh tool in **form•Z**.

TECHNIQUE: *"A way of accomplishing a task that is not immediately obvious."*

Much of the development of furniture product is created through a process of trial and error. Materiality is a big part of this in the woodshop. The trial and error approach is one of experimentation, exploration of the best, most efficient method of creating the object we want. This holds true for the process of making in **form•Z** as it does in woodworking. Yet **form•Z** gives us additional options for creating sculptural forms – two source sweep for example – that are conceptually based and a departure from the tradition based Boolean operations. These are options that designers explore through their own process of trial and error in the software environment.

The creation of this table in **form•Z** took little time relative to the physical effort, time and expertise in working with a material required of the furniture maker. As I reflected upon this relatively swift mode of creation, I realized that there is a great difference in working with a material that brings with it properties and peculiarities, and its own inherent textures. Wood workers will point out the difference between working with maple or mahogany – while the overall processes used to achieve a form may stay the same, the difference of the materials is felt through the hands on nature of woodworking. Part of the reward of working with wood is accentuating and selecting the material details and textures, and revealing them through the sculptural process of creating form. In the virtual world, it is comparatively easy to create the desired form, the texture of the material being applied as a secondary consideration. This difference allows the user of software to experiment with the form and the materiality of the sculpted object from a different perspective, one that can push the boundaries of a form beyond that prescribed by the material. Here then we can move beyond the consideration of what form, for example, a brick would wish to take as considered by Louis Kahn, and begin to push the perception of what forms the material can be applied to.

TECHNOLOGY: *"the study of or a collection of techniques."*

For makers accustomed to the traditional methods of making, software such as **form•Z** provides opportunities to innovate both creatively and in the methods of production. It is difficult however to entirely remove the presence of the woodworker; nor might one want to in certain fields.

I see three possible areas that digital technologies can contribute to the furniture maker: conceptual/creative, selling the idea, and efficiency of production. On the conceptual/creative level, possibilities presented by the software affords the craftsperson the opportunity to step back from the prescriptions of a material and consider a range of forms outside of the context of material, opening up a

whole new realm of possibilities. In selling work, the ability to create digital, often photo realistic, representations of an end result can be of great value in selling work as it allows the client to visualize the product beyond the traditional elevation or perspective hand sketch. I asked Peter about the value of digital technologies to his work.

"Yes, the capability of 3D software to provide a visual representation is of great help in selling one's craft; but it can also be restrictive – once a patron is sold on what appears to a photograph of an end product, it can be difficult then for the maker to exercise an independent judgment during the process of making, to change dimensions, details or materials."

So, the powerful possibilities of digital representation of custom furniture should be recognized, and managed – carefully selecting what is modeled, what views are shown and what degree of photorealism is sought.

I also asked Peter about the possibilities for incorporating modeling software into his making process:

"Part of the appeal of what I do as a craftsperson is that my work is created by my own hands, each piece being different and unique. I am a designer but I am also a maker. That said, if I had an interest in mass producing this table, then the modeling software could be used in conjunction with a 5 axis router to create the solid components and the veneers could be laser cut…I imagine that this would be precise, efficient and would cut labor cost…"

It is my point of view that though the maker's hand would be reduced by the use of software in conjunction with machinery, it could never entirely be removed from the process of making – the material selection and working to produce a refined finish are elements that require a discerning and experienced eye and hand.

So, while digital software may offer ways to make production faster and easier, this does not necessarily mean that it usurps the role of the maker or undermine the value of craft:

"A lengthier making process does inform my design. Decisions about shape and form often develop through making: You have a rough idea of where you want the form to go, but it is not always something where you could look at an end result and decide what you do or don't like, it's a shape that develops through making, and the decisions made along the way. Oftentimes design decisions that determine what things will look like are made through full scale drawings and templating before it is built and then refined to a final shape through the lengthy making process…"

But is there not a digital equivalent to the lengthy making process? Are we not able to adapt and refine through iterations of the software environment: creating an object, applying materials, placing it in a context to test our reactions? Coupled with easy access to compatible production machinery, the designer/artist/maker would be able to incorporate the physical product with this process of

Figures 14, 15: The final table: from the Workshop, and from **form•Z**.

refinement. Still, for furniture makers whose perspective is shaped by the prevalence of traditional methods of making, this argument will only be successfully made in the context of a wider adoption of modeling software such as **form•Z** by their peers in the maker community.

You could get a rough idea of what something would look like in a new design but in terms of adapting designs to different sizes and subtly refining the form to fit the new proportions, I don't know that this can be done digitally. It is this level of refinement of design that comes from a lengthier making process and which is often missing from mass produced work – you can make a cabriolet leg with five axis machinery, but it will not have the grace that a cabriolet made by hand will have."[1]

In considering how a furniture maker with no formal training in using modeling software might be encouraged to adopt **form•Z** as a new technology or tool in his toolbox, it strikes me that **form•Z** would need to be an immediate and intuitive benefit to the maker whose focus tends be practical considerations. The software would need to address the following questions: First, can I draft with this? Is it intuitive enough for me to figure out how to digitally produce the traditional drawings I am familiar with? Second, can it produce a model of an idea I have already defined through traditional methods? Can it perform in a way that I understand, with functions analogous to the tools I am familiar with? With these conditions met, I would speculate that the creative maker would establish a level of comfort with the program and begin to experiment with incorporating this technology into the conceptual as well as making processes.

Figures 16, 17: The final table: from the Workshop, and from **form•Z**.

Conclusion

As I modeled this table and reflected upon the processes used, the possibilities and implications of digital technologies for the furniture maker, I came to understand that making in the virtual and real worlds are not just separate yet parallel processes, but that digital exploration of form can itself become another tool for the furniture maker. The possibilities provided by digital modeling extend beyond just that of generating an image of an intended object but can influence creative possibilities and the making process. So, as a tool, **form•Z** has great potential for the maker. In order to become more widely adopted by the woodworker, software such as **form•Z** needs to be intuitive, multifunctional (meeting the everyday drafting needs of the maker as well as providing its current modeling capabilities), and the machinery used in conjunction with the software more affordable, easily accessible, to the individual maker for the purposes of experimentation and development of technique. While it could be argued by some to challenge traditional methods of conceptualizing and creating furniture, the adoption of digital technologies as a tool by studio furniture makers, and the broadening of techniques this represents in addition to those offered by tradition, is already underway.

Note:

[1] For a more complete discussion of the use of digital technologies in making, and the debate about balancing digital methods with the traditional values of craft, see 'Furniture Makers Exploring Digital Technologies, ed. John Kelsey, 2005, The Furniture Society; For an interesting review of the history and modern practices of producing bent lamination furniture, an example of the role of modern production machinery and software in furniture making , see 'Bent Ply' by Dung Ngo and Eric Pfeiffer, Princeton Architectural Press, 2003.

Naomi Crellin is a Graduate student at the Rhode Island School of Design in the three year Masters of Interior Architecture program. Prior to her studies at RISD, Naomi received her undergraduate honors degree in Modern History and Political Science from the University of Sheffield, England. In addition to designing and making furniture with her husband, Peter Trumbull Crellin, her prior professional experience includes working in professional development and training for a global strategy consulting firm, and in human resources and business administration for an architectural firm where she led the creation of a formal professional development system. During her studies, Naomi has maintained an interest in learning and development and has been appointed to teach the Introduction to **form•Z** course offering by the department of Interior Architecture during the 2007/8 Winter session.