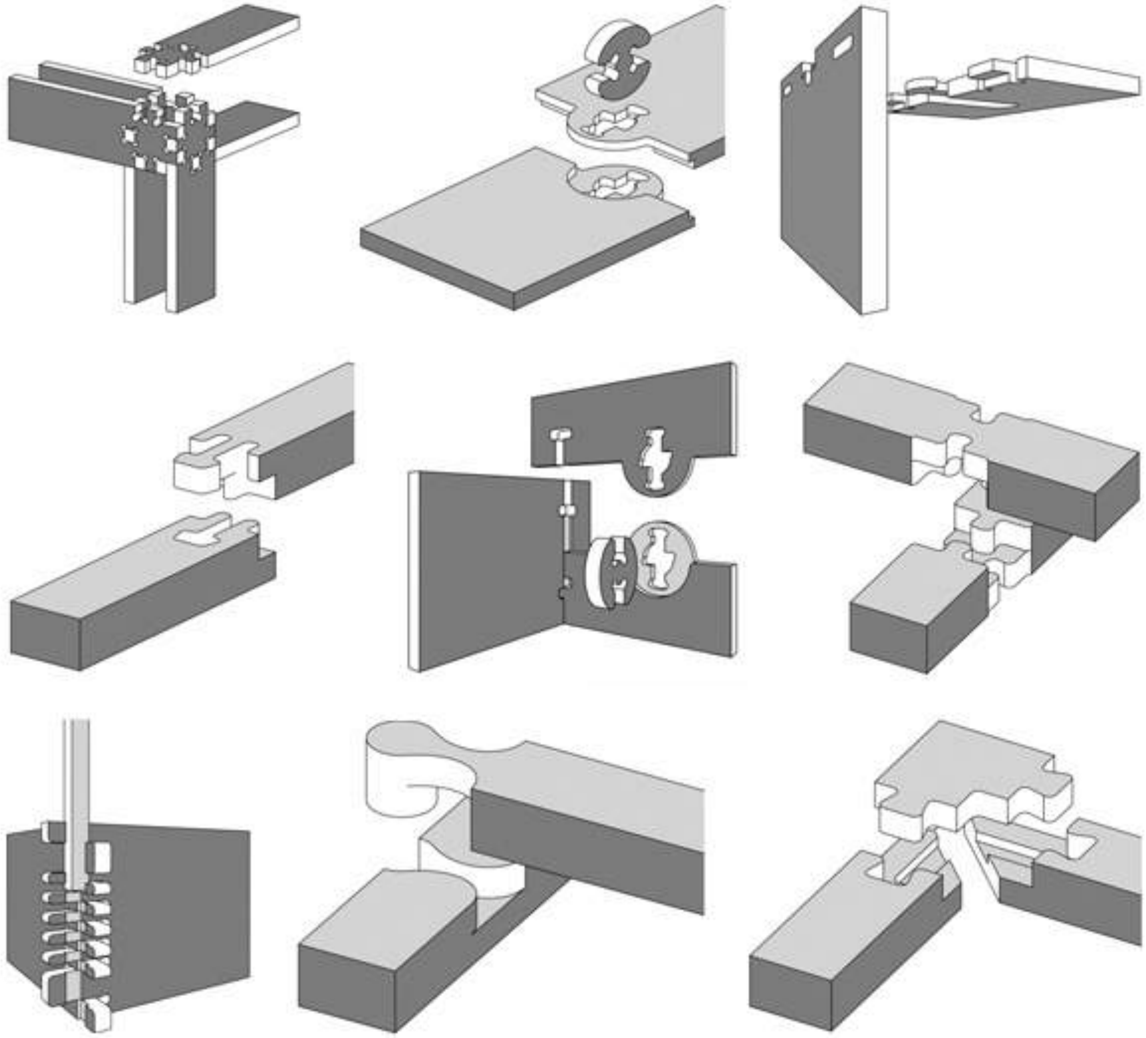
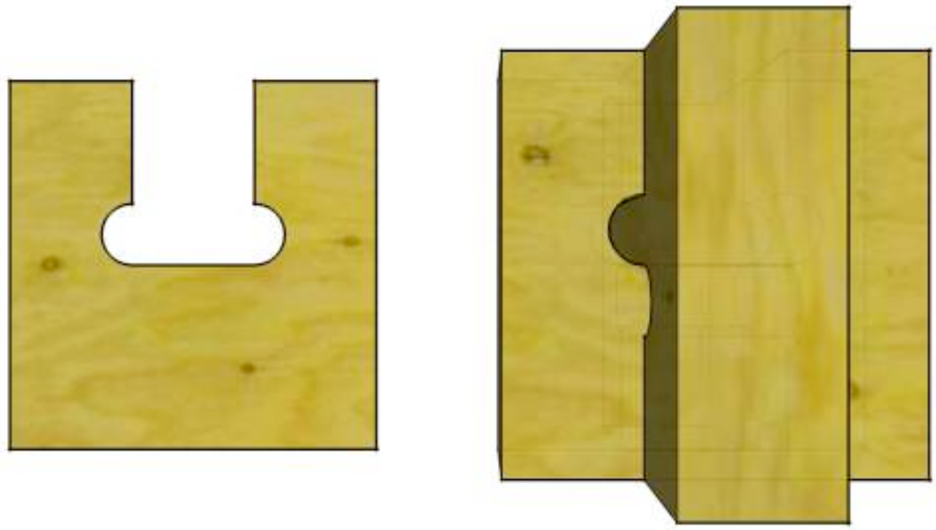


For this article, though, I'm deliberately considering a very limited case: Two (or even just one) cut parts, no partial-depth cuts, and a cutting axis always at 90 degrees to the surface of the stock. Even with these limitations, the possibilities are rich.

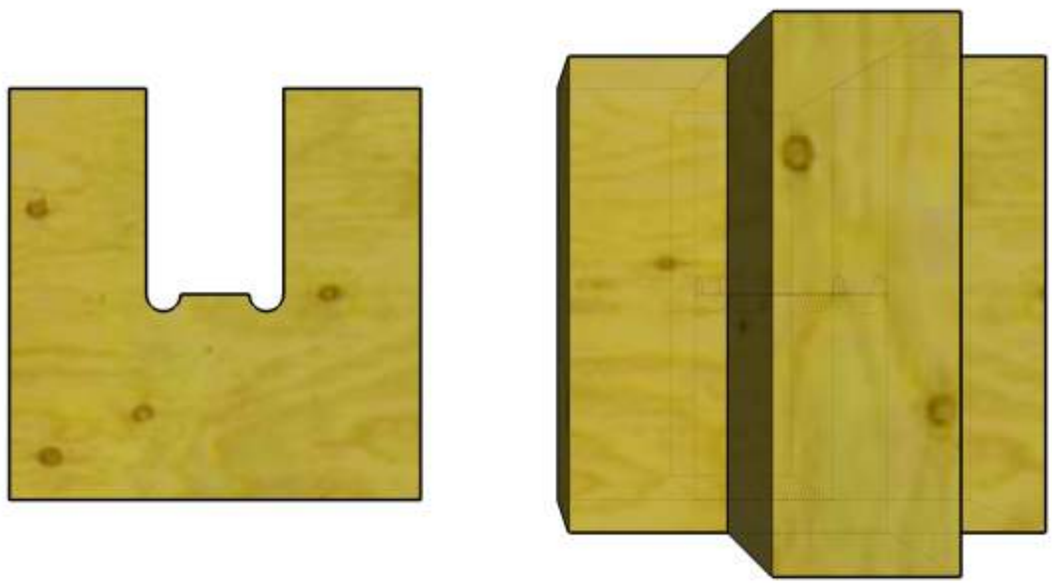
Laser vs. Rotary Cutters – The Inside Corner Problem

Hobby class laser cutters and CNC routers each have advantages and disadvantages. Laser cutters can cut much finer details because they have very small "kerf." On the other hand, they're more expensive and can't do partial-depth cutting or "pocketing" like a CNC router can. They also use heat, which can burn the substrate and/or generate nasty off-gassing. On the other hand, the burning effect can be used decoratively. A CNC router can change bits and cut complex relieved surfaces, or make cuts with mitered or otherwise profiled edges. I don't think either tool can be described as simply "better," and, with one minor caveat, all of the techniques presented here can be used equally well with either a laser cutter or a router.

Because of its very small cutting channel, a laser cutter can produce an inside corner with a sharp angle, whereas a rotary cutter using a physical tool is limited to inside corners rounded at the cutting tool's radius:



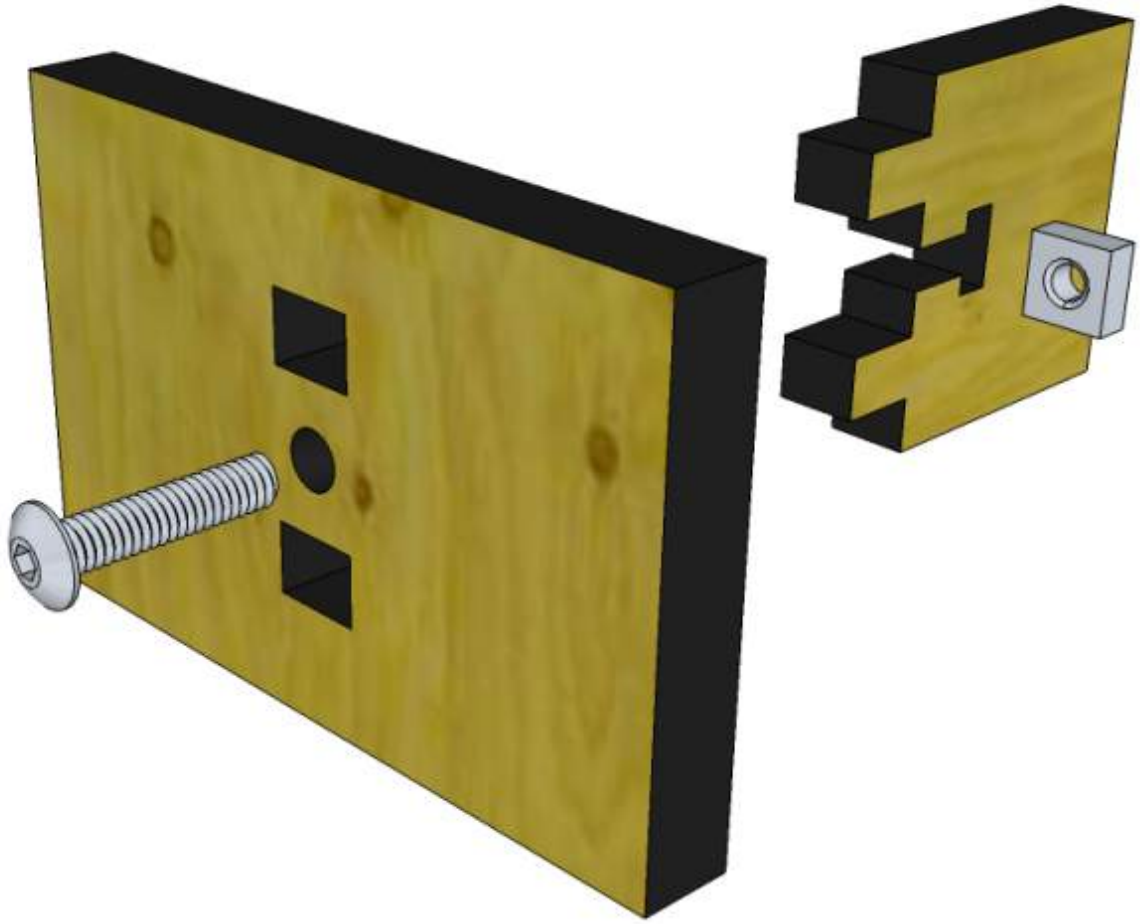
Now the inside faces of the edge laps mate cleanly. On the other hand, the round divots are visible in the assembled joint. If that bothers you, of course, you can also do it this way, if your cutter is narrow enough:



On average, this method offers the best compromise, IMHO: The flat areas between the divots seat against each other firmly and the divots themselves are concealed inside the joint.

To simplify presentation, the joints below are presented with ideal “laser cut” inside corners. But all of them should be readily adapted to rotary cutting by using the divot method shown above.

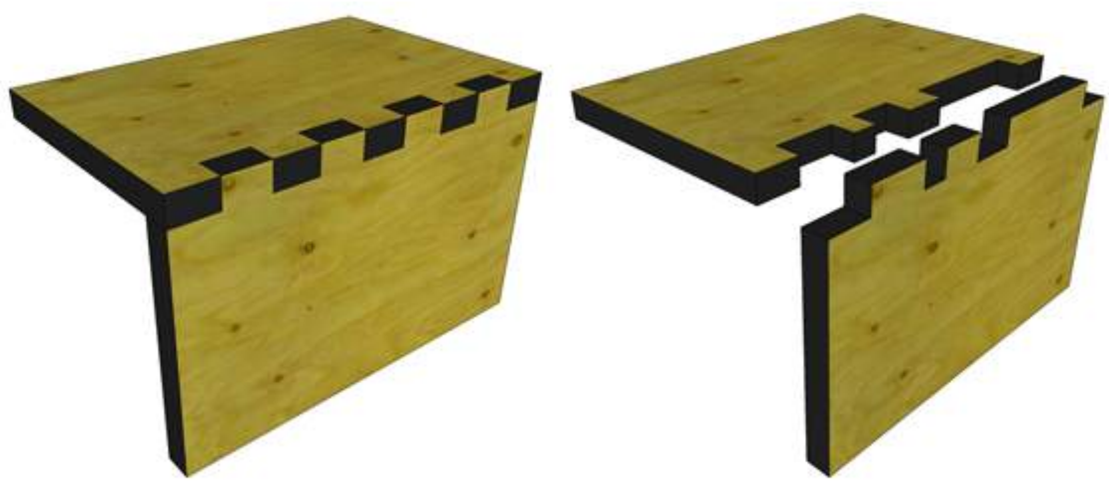
Biasing



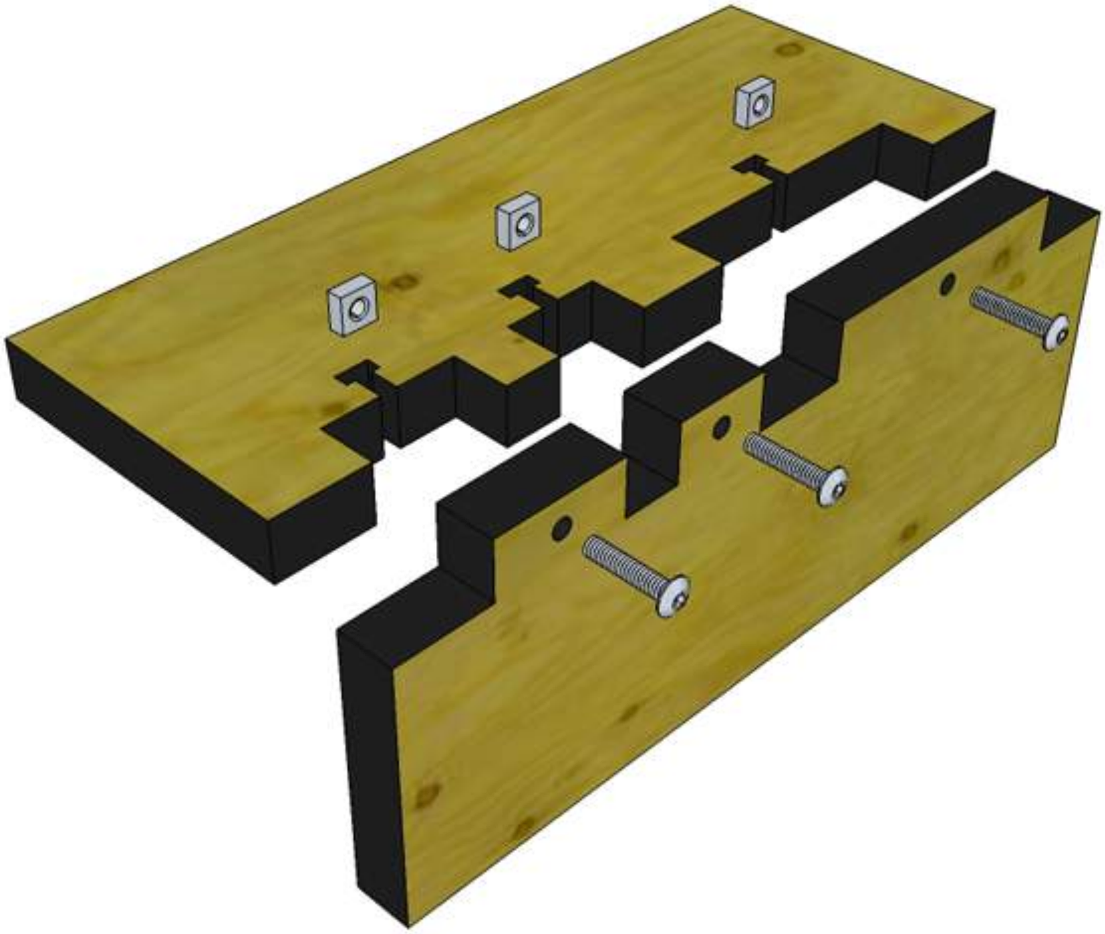
This particular configuration was the subject of a nomenclature debate here on the blog not too long ago, though I don't think any sort of consensus was achieved. Interesting possibilities include "captive nut joint," "bedframe joint," and "Pettis joint" (which is my personal favorite, because it observes Stigler's Law).

There are almost certainly other clever ways to incorporate metal fasteners or other bits of common hardware in this type of joinery that I haven't seen, and/or that have not been invented, yet.

Corner ("L") Joints



This arrangement of interlocking tabs and slots at a ninety degree angle is, of course, ancient and rudimentary. Most people call it a "box joint." It, too, can be biased by breaking symmetry.

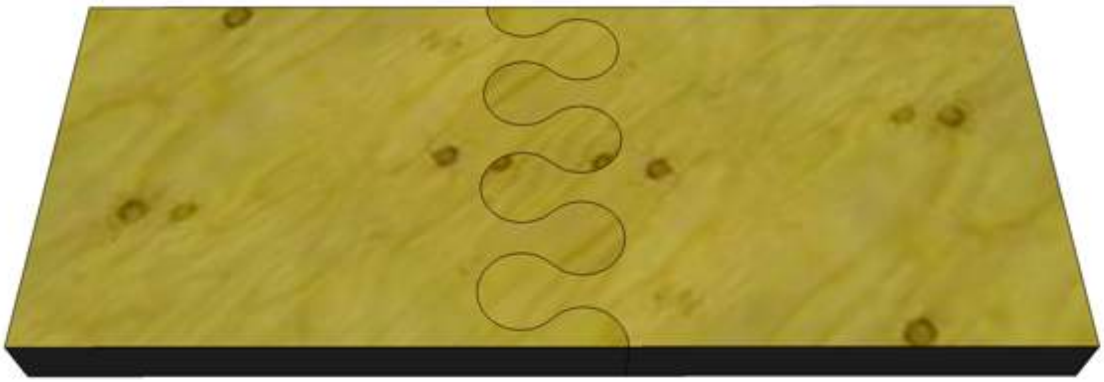


And it is just as amenable to the bolted captive-nut arrangement.

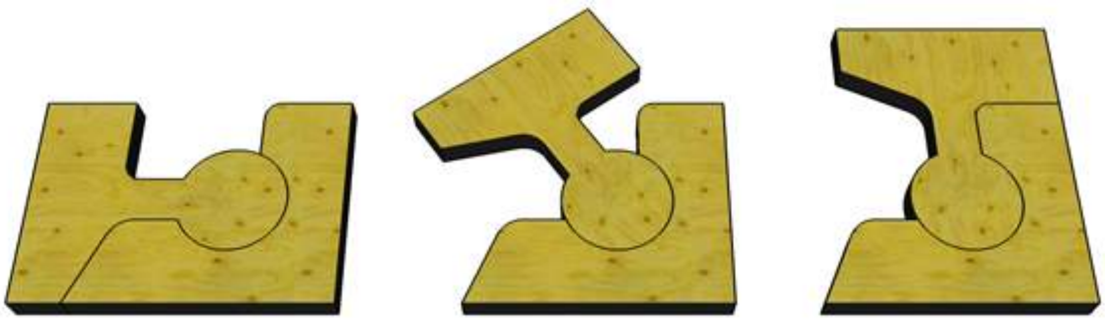
Oblique ("V") Joints

Though the captive-nut joint doesn't really work unless the two parts are at right angles to one another, generally the "L" joints can be pressed into service for acute or obtuse angles, as well.

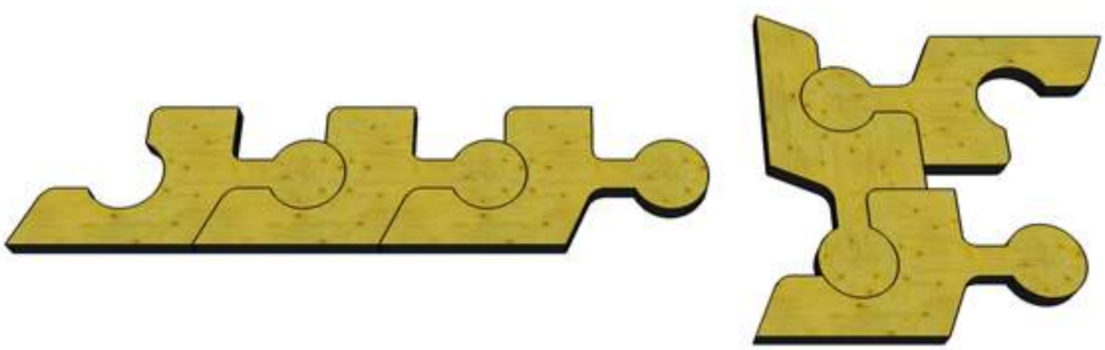
The bottoms of the slots no longer index closely against the surface of the stock, but if the members are held in alignment by some other means, for example by glue or the introduction of a third panel (as shown to right), it may not matter.



This interlocking "bulbed" version doesn't depend on glue for its strength in tension. If left unglued, of course, these flat joints require some means to keep the two pieces in the same plane when the joint is in use. Here is a variation of the "bulb" joint that allows for in-plane hinging action:



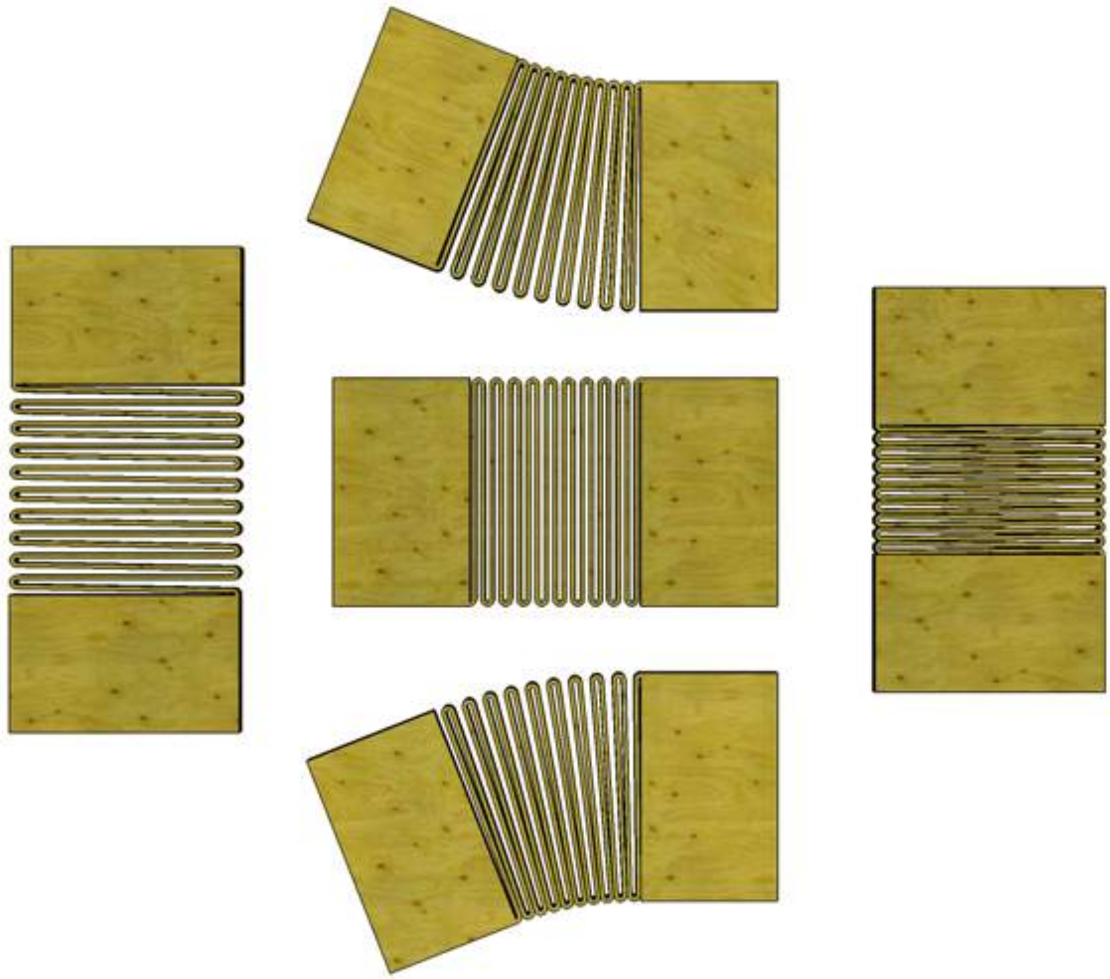
I want to call this a "Kanelba hinge," for George S. Kanelba, of New York, whose "Cube Desk" project in the 1984 Popular Science book 67 Prizewinning Plywood Projects is the only place I've ever seen it.



Kanelba hinges can be daisy-chained to make "snakes." The individual hinges, of course, can be set to "stop" at angles other than 90°.

Flexures

Though not strictly "joints," there is a class of clever CNC tricks that meet our criteria for inclusion here (two or fewer members, all-the-way-through cuts at 90 degrees) that are designed to exploit the natural elasticity of the panel material itself to create living hinges, springs, and other dynamic flexing elements. We have already broached the subject of integral flexures with our discussion of catches and detents, above.



This is an in-plane spring or living hinge element that is kind of like kerf-bending, but with "thru" cuts. If not constrained to motion in the plane, such a feature will be pretty unstable. Here's a version more suitable for out-of-plane bending:

This is the somewhat famous Snijlab living hinge technique (which I continue to believe should be called a "sninge"), an accordion-cut pattern that allows for stable out-of-plane flexing. It is most commonly executed in laser-cut plywood, but there's no reason it couldn't be cut with a CNC mill and/or in other materials, though a router-cut sninge will have to be longer to achieve the same degree of flexibility as a laser-cut version, because the router slots will have to be considerably wider.

Finally, here's an oddball free-hanging spiral technique, courtesy of the good folks at PlasmaCAM. The spiral is cut out of a piece of steel using a CNC plasma cutter, but the same idea could work with a laser cutter or a mill, in a different material.

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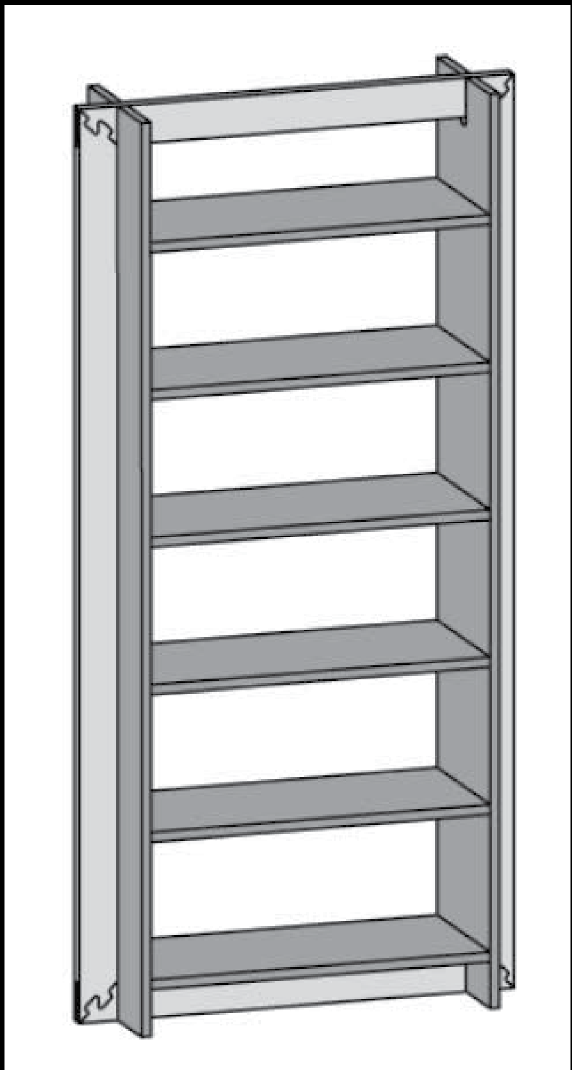
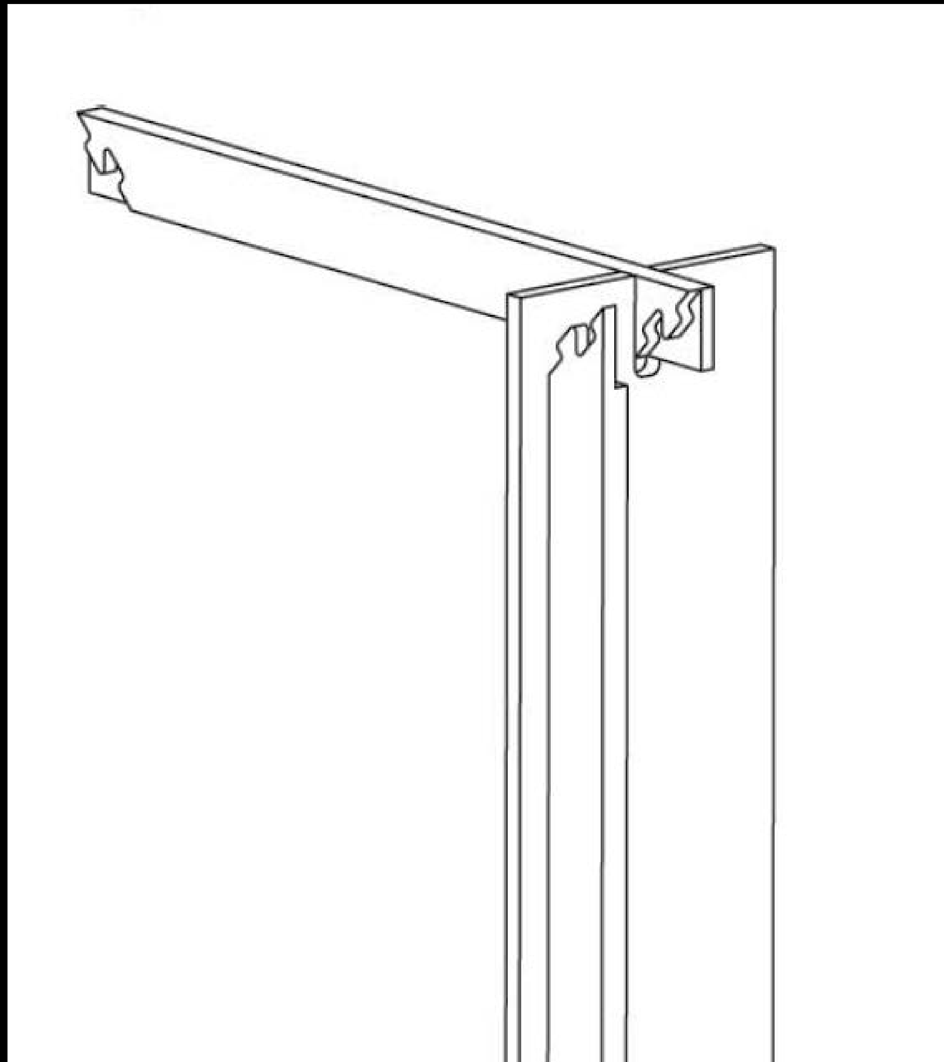
VISUAL ARTSUWM


Combining Planar and Linear

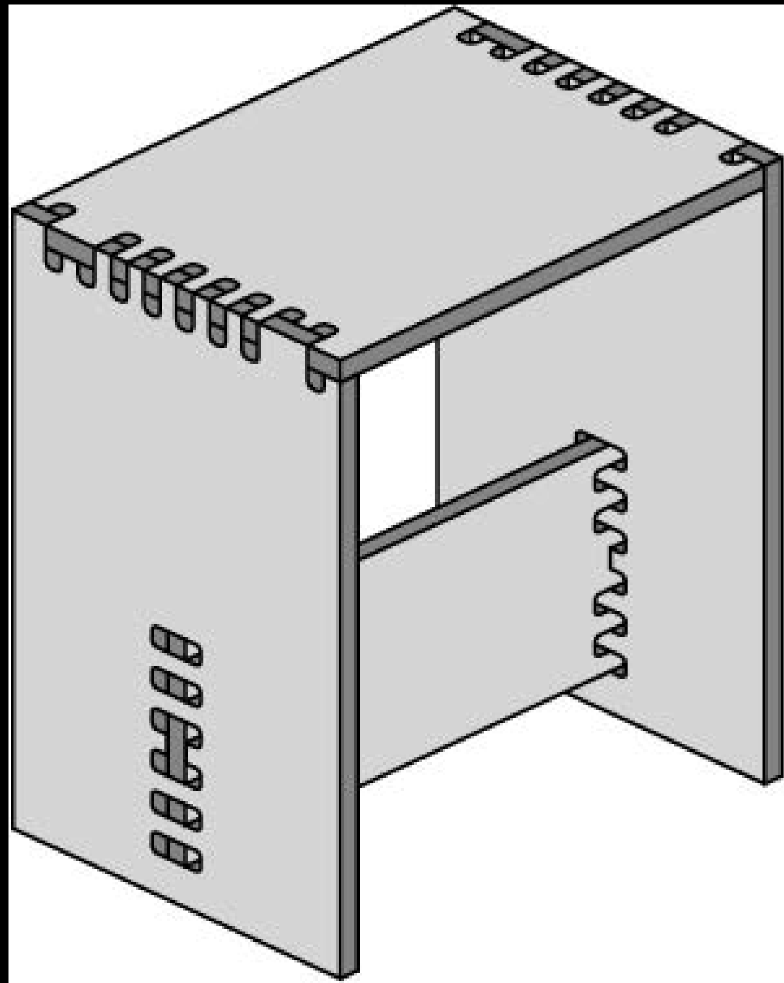


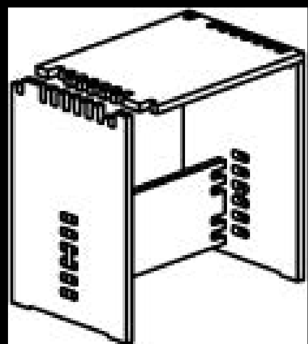


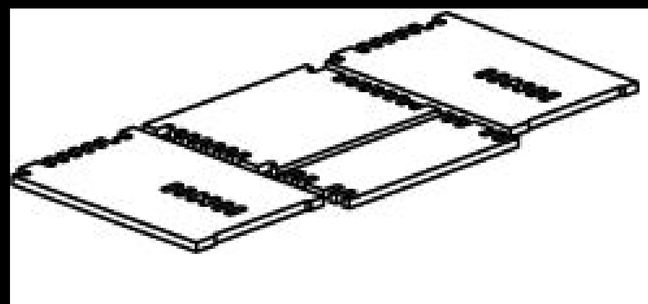
C...Stool - Jochen Gros

Made to clearly show the work done by the CNC as part of the aesthetic design.

By exposing the Finger Tenons, the process of milling and joinery is made transparent



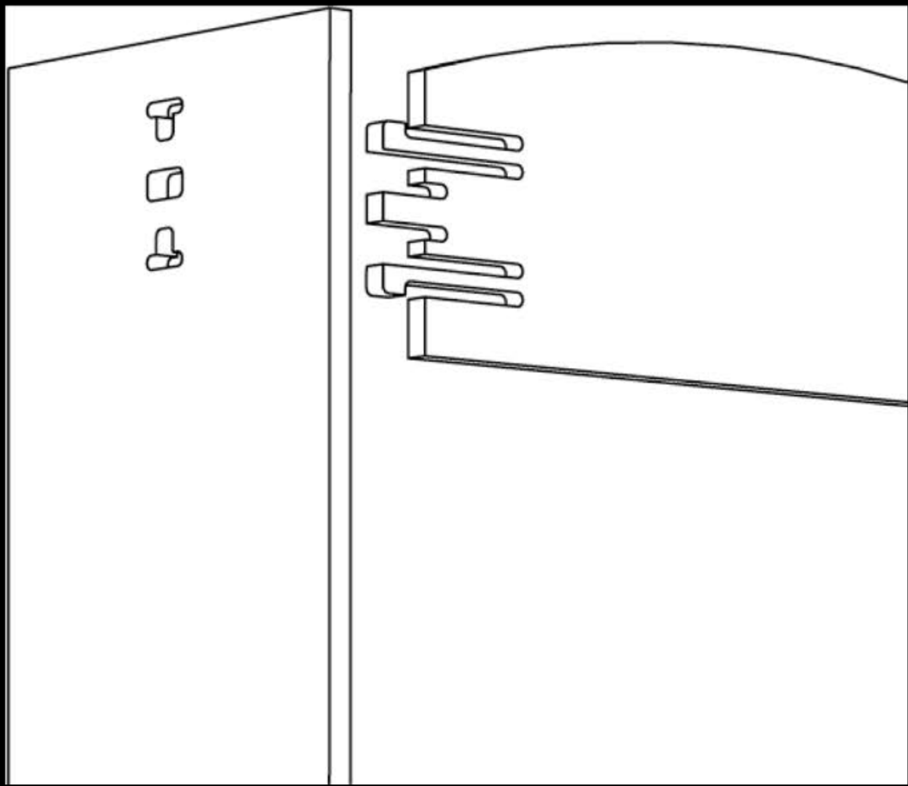


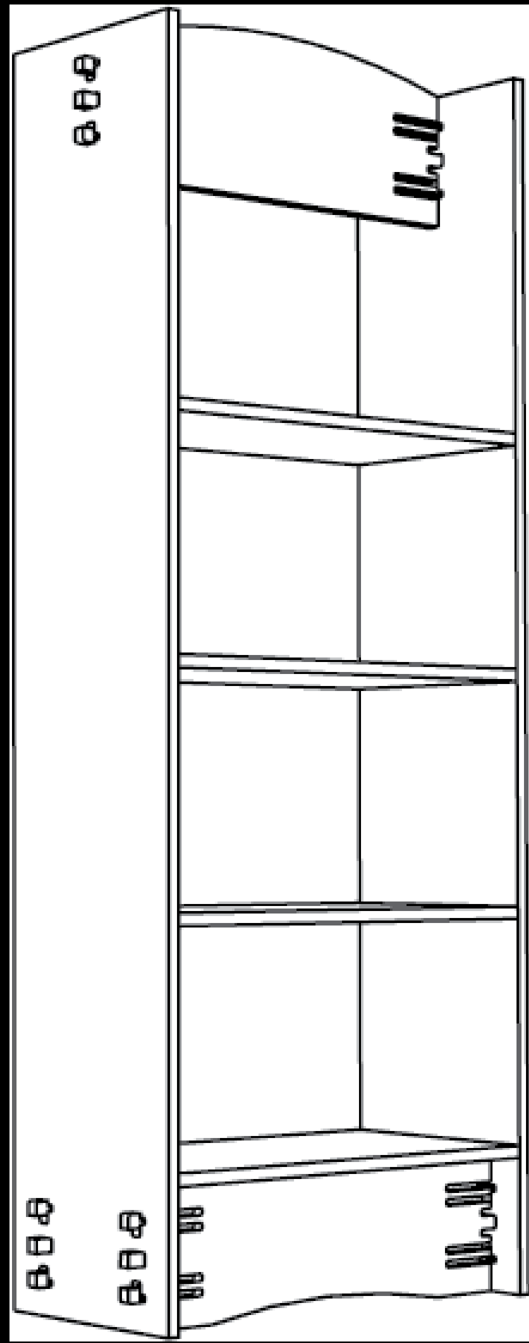


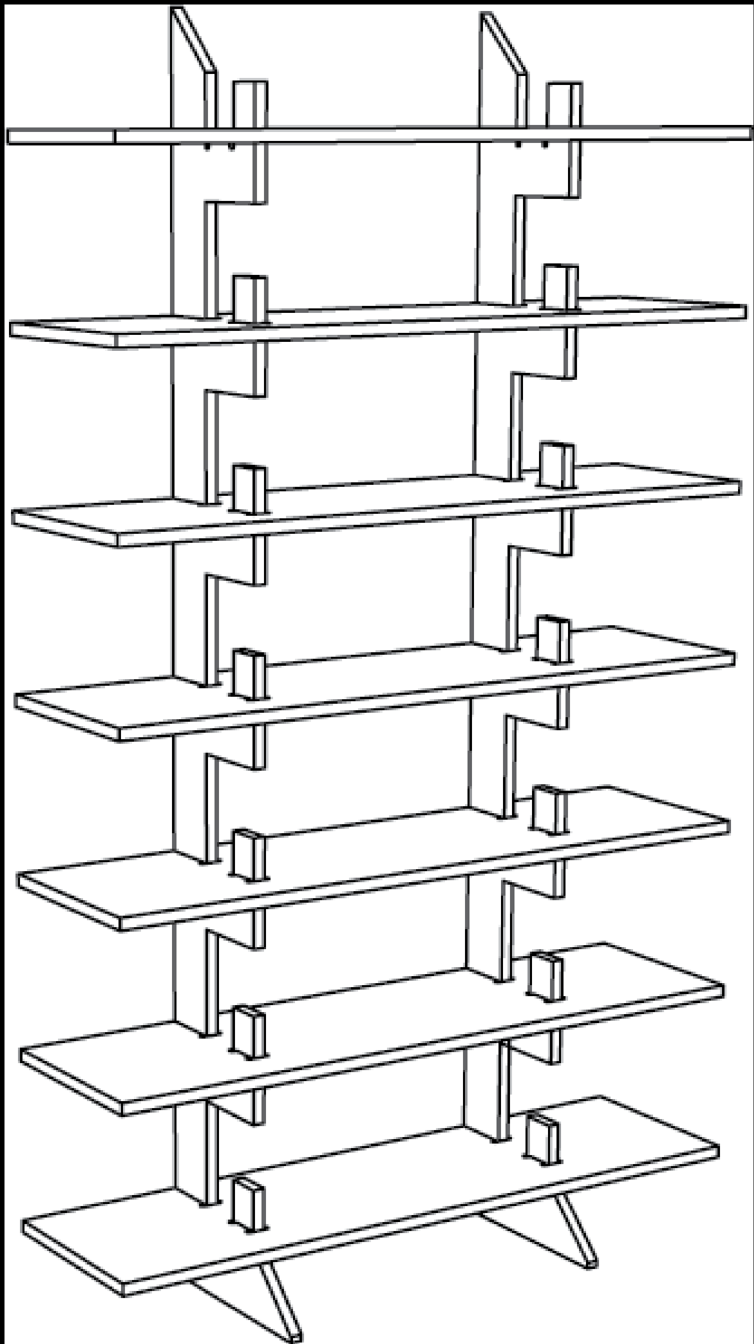
Clip Shelf

Crossbars are clipped onto the sides using a Clip Tenon Joint.

The shelves are mortises in the sides by means of Finger Tenons.



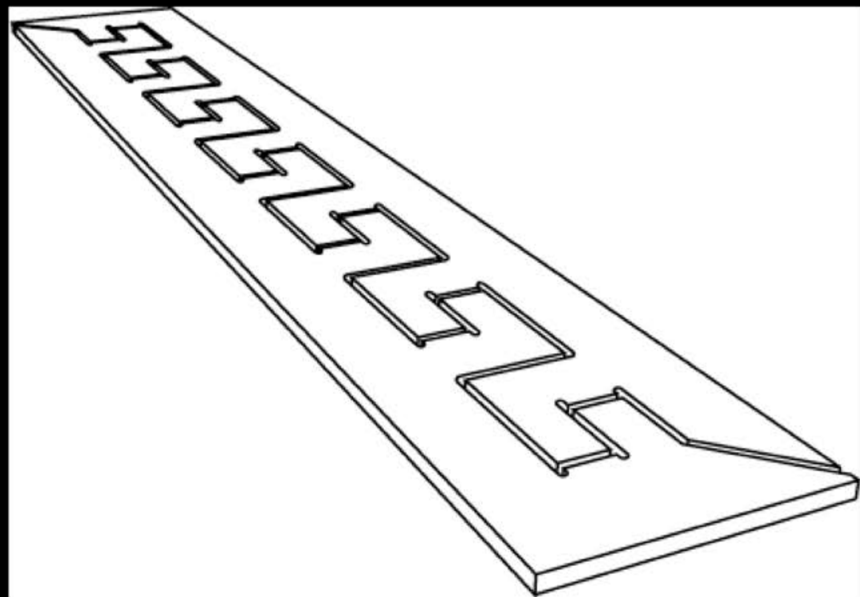




Meander Shelf

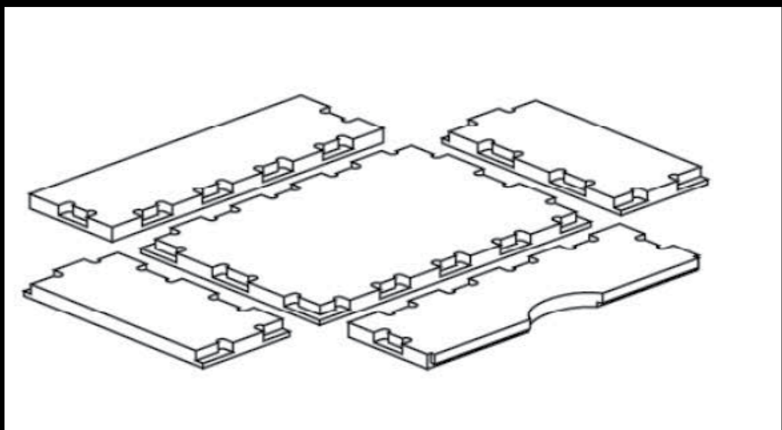
Designed as a simpled shelf that would slot together without requiring tools, and still have the least amount of trim waste as possible.

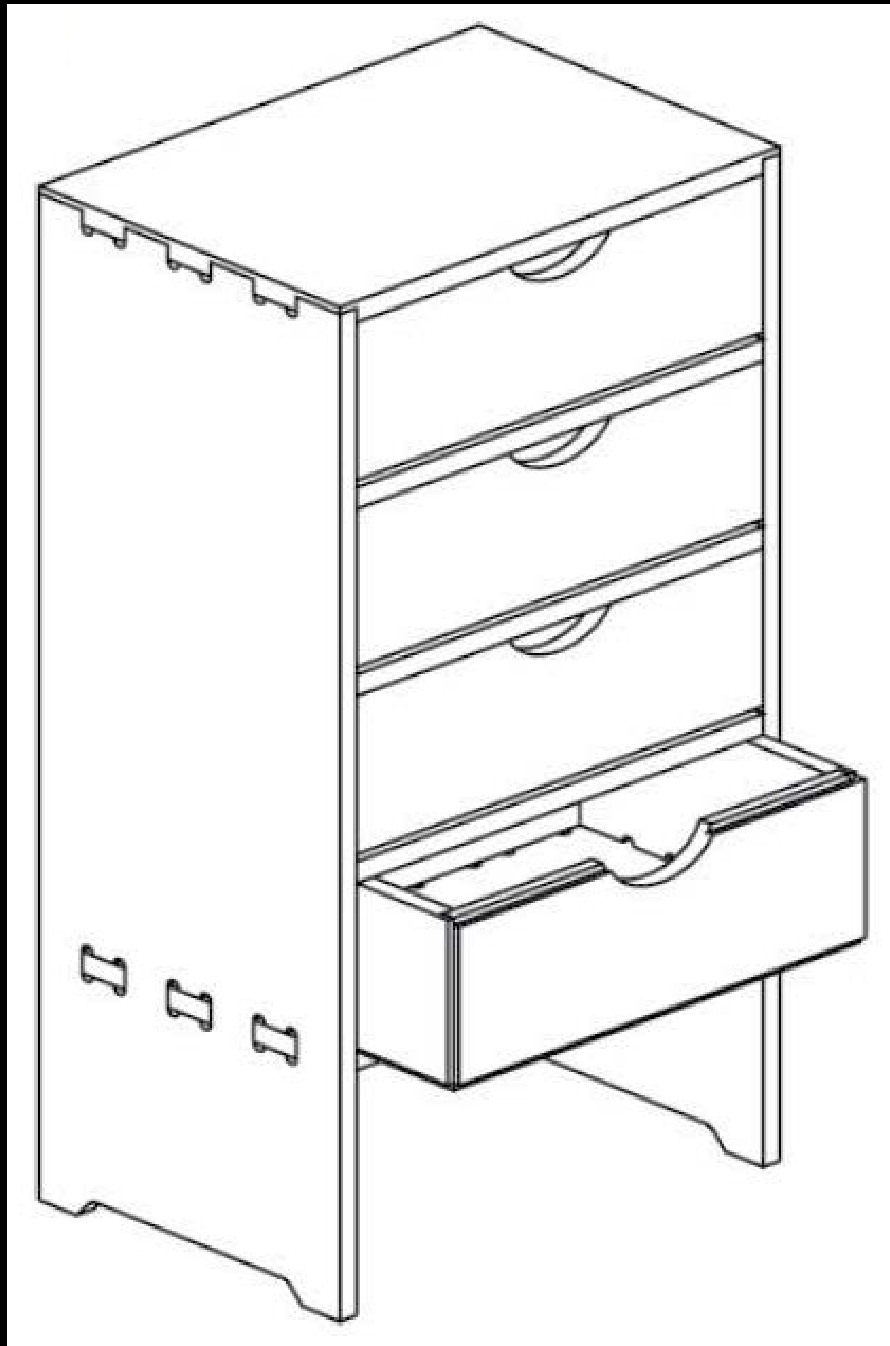
The two shelf bearers are shaped in such a way that they can both be produced from the same board by using Slotting Girder Joints as the interlocking shape.

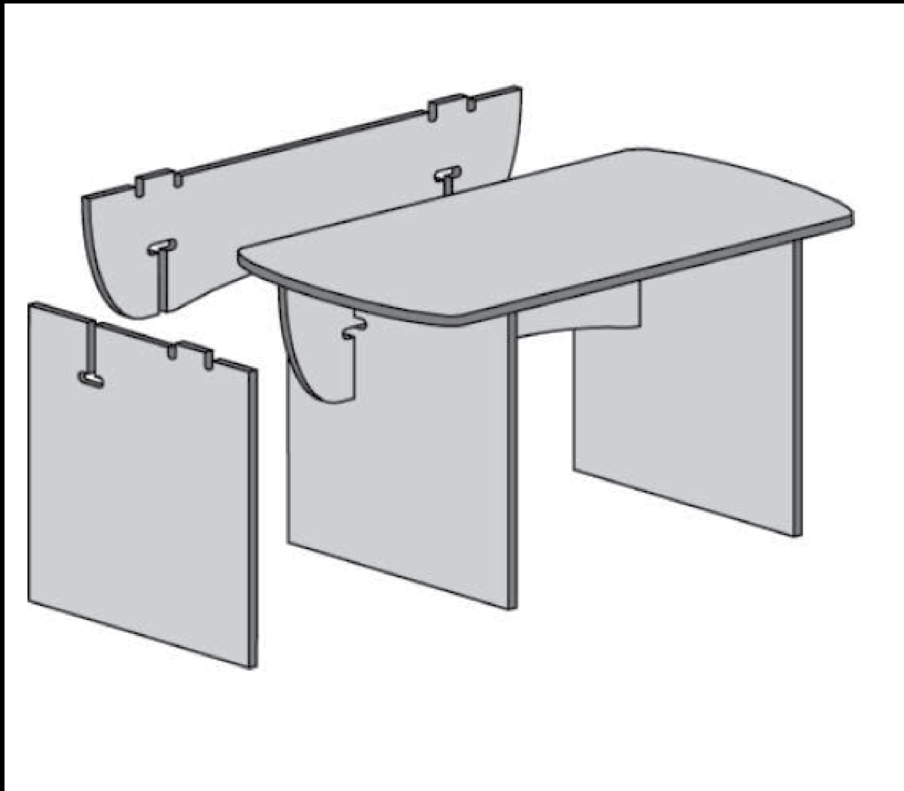


Chest of Drawers

Top shelf and sides are joined by Lapped Finger Tenon Joints, while the bottom shelf is mortised through the sides by Finger Tenons.



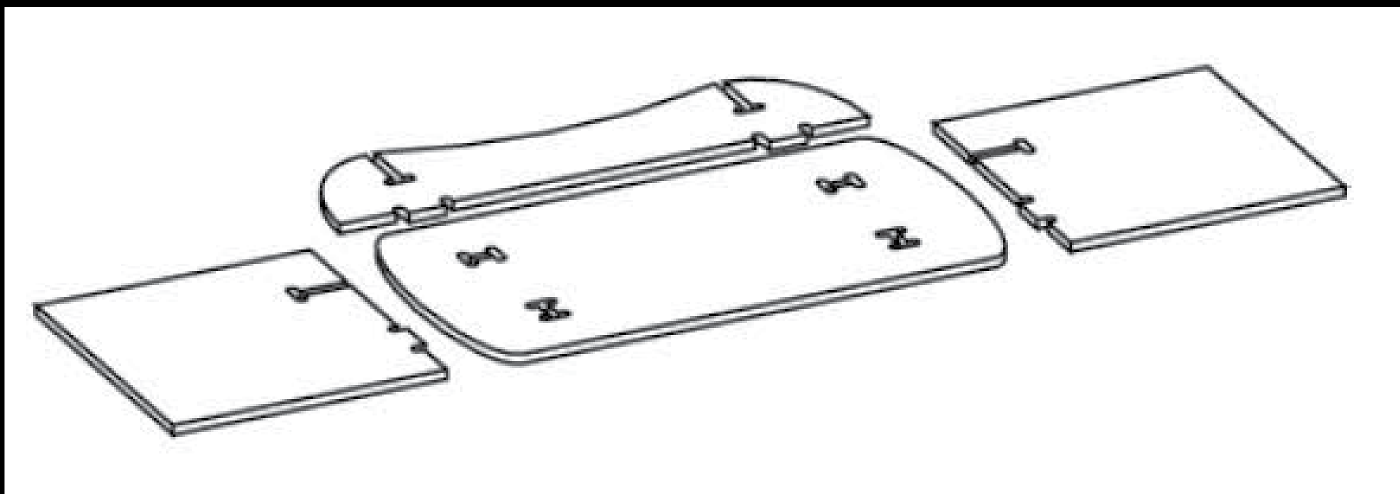




Simplizissimus-Table

Designed to be as a simple construction process, all the elements are machined together from the beginning.

The resulting pieces can be put together with no tools using Simple Sotting Joints and Finger Tenons.



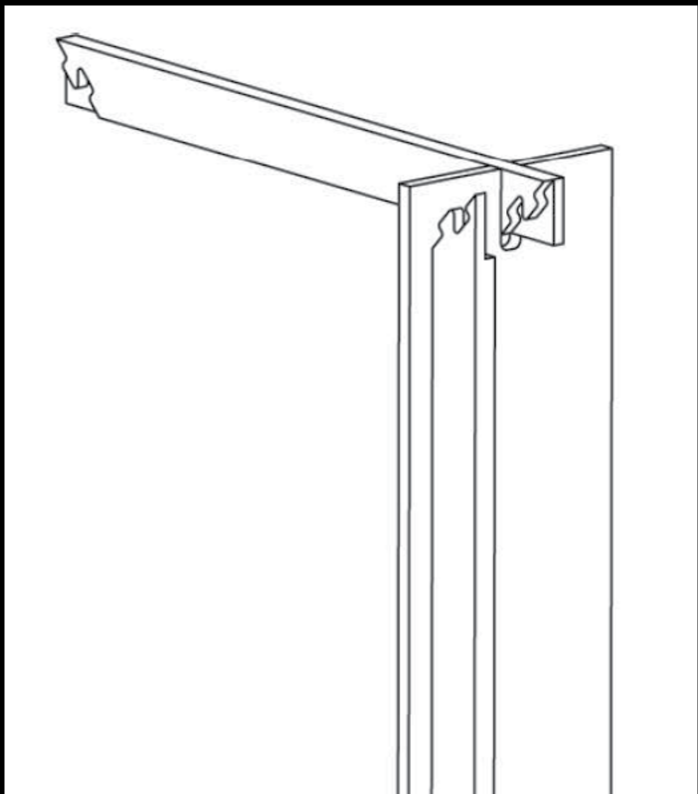
Joint Chair

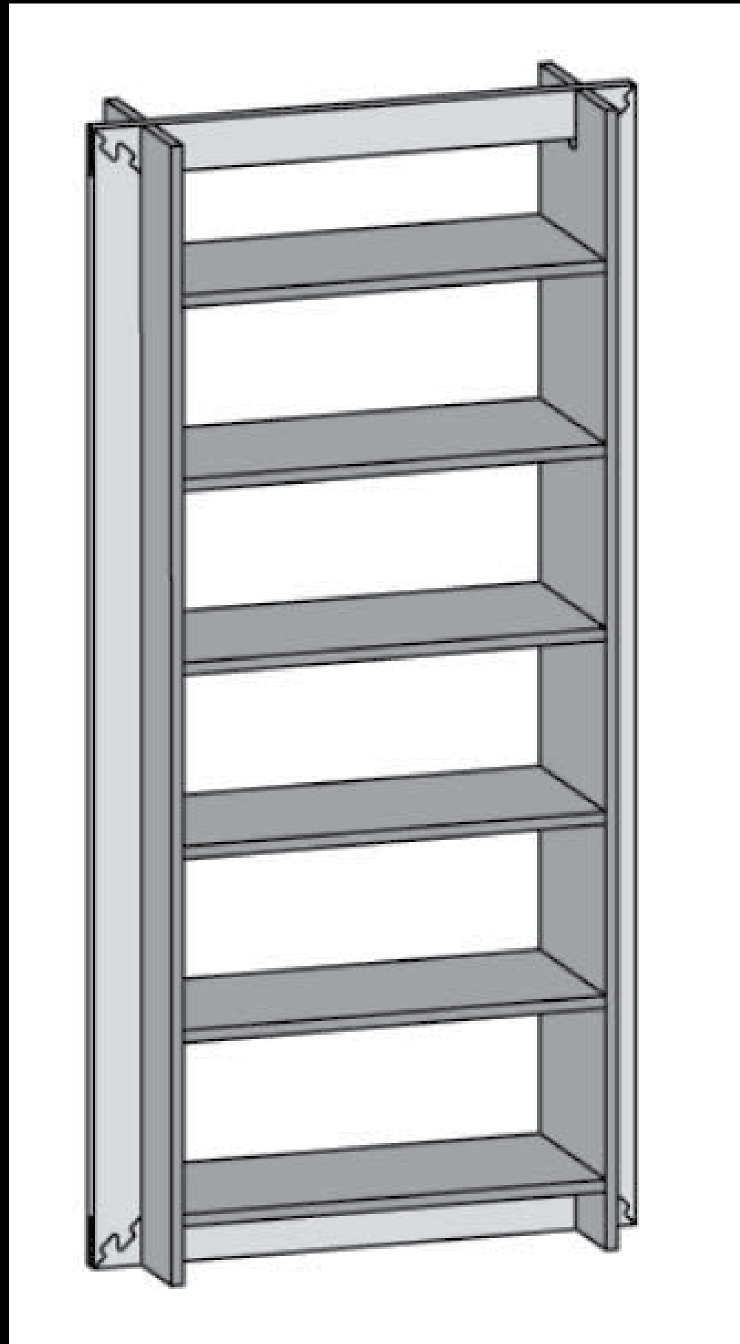
Sebastien Wierwinck Plywood Chair

Frame-Shelf

The wood sides and shelves are bound in place by the linear frame.

The frame members are held by Jigsaw Mitre Joints left exposed for decoration.





Zoom-Table

Designed to maintain a constant proportion between its length, width, and height; making the number of Lapped Finger Tenons remain the same no matter the size of the table.

The table joints on the side help prevent deflection of the tabletop when loaded.