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Dave Campbell  
Editorial Content Chief, *WOOD* magazine



## Adobe Acrobat Reader Troubleshooting Guide

If you can read this page, your Acrobat Reader program is working correctly! But you may still have problems or specific issues, such as printing and saving your downloadable file.

### My printer won't print the text correctly

Almost all printing problems are due to not enough free system resources memory. The files are very memory intensive because they include graphics, text, and photos. Close all other programs/applications and print directly out of the Acrobat Reader program, not your Web browser.

### Patterns are not printing full-size

Make sure your printer is set to print at 100 percent, "print to fit" is not checked and "page scaling" is set to "none". These settings are selected in the printer setup or printer options.

### I can't find my file now that it's downloaded

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# Prototyping

Makes

# Perfect

**To err is human;  
to refine before building, divine.**

**W**hether you're a hobbyist trying to get a better sense of a project's "feel" or a professional craftsman pitching to a client, prototyping can help you test a design's structural integrity, functionality, and comfort. Building a prototype also helps you become familiar with a new or complex technique with no risk of mistake on expensive stock. You may not need all these techniques for every project, so select and use only the most appropriate method for each job.



Finished chair



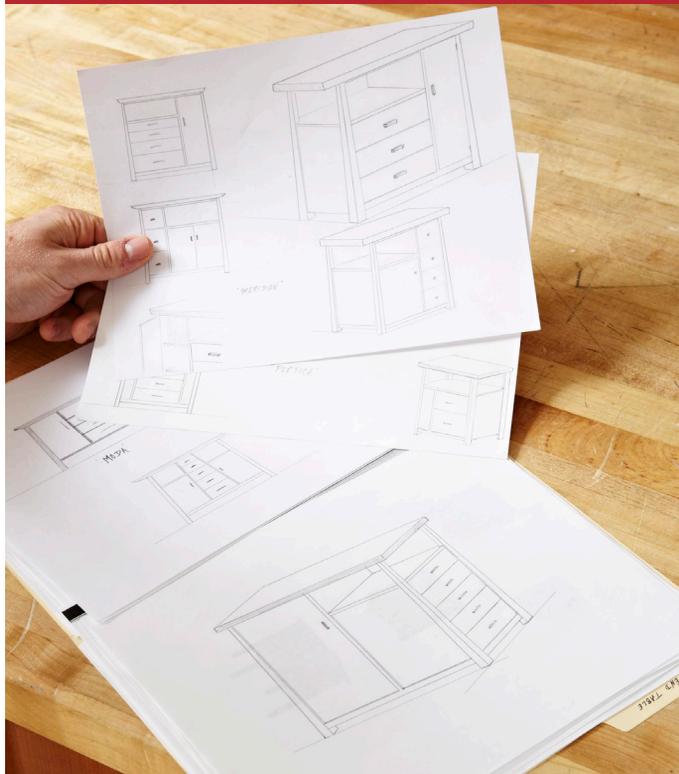
Full-size prototype built  
from construction lumber

1/3 scale  
design concept

## 1. Start with a sketch

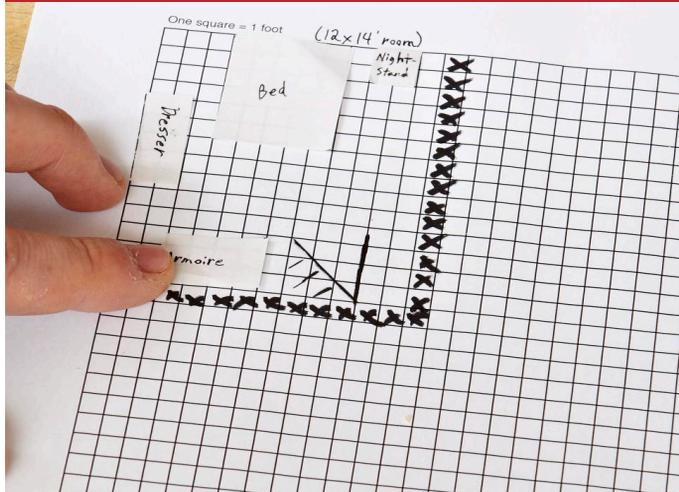
To help you visualize a project and determine which lines and proportions appear most pleasing, make a series of sketches from different perspectives and with various dimensions (*below*). Keep grid paper handy to determine how a new piece of furniture will fit amid doors, windows, and existing pieces in a room (*bottom*). If your sketching skills are, well, sketchy, use 3D modeling software, such as SketchUp, to generate scale drawings of your designs [**More Resources**]. Once you've modeled, you can rotate the drawings on-screen to view the design from any angle or distance.

### KEEP A SKETCHBOOK...



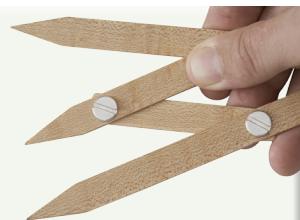
Doodle project ideas in a sketchbook. Even if you decide on a different design, review it again later when you need inspiration or fresh ideas.

### ...AND A GRID PAPER LAYOUT GUIDE

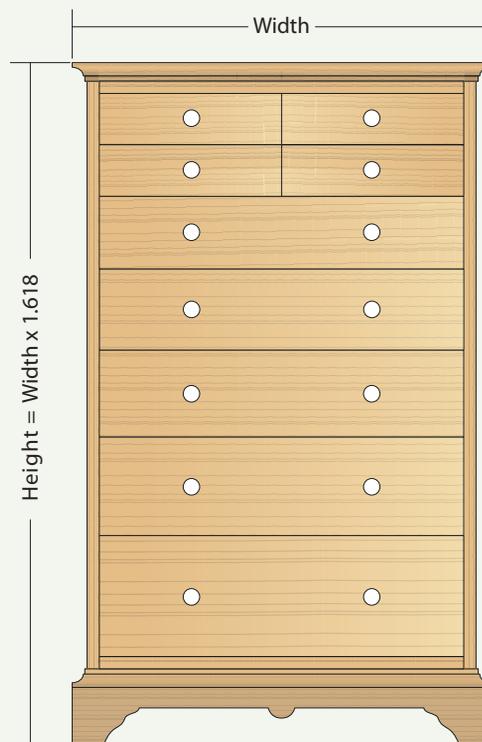


If you have any doubts about how a project will fit in a room, or the project's best size, lay out the room virtually using a grid with scale cutouts of furniture.

## 5 must-know design principles

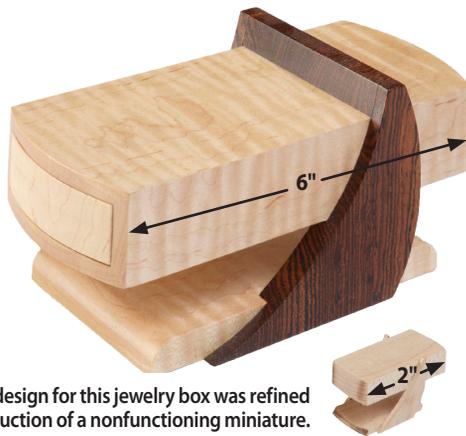


- 1.** When developing design concepts, start with the Golden Ratio, an ages-old method for determining pleasing proportions. It calls for a 1:1.618 ratio between adjoining dimensions; such as height and width, width and depth, height and drawer or shelf placement; or the most visually appealing location of hardware such as hinges or pulls. For example: Break down the dimensions of a nicely proportioned 5"-deep, 8"-wide, 3"-high jewelry box, and you'll find that multiplying the height by 1.618 yields 4.85" (which can be rounded up to the 5" depth), and 4.85" multiplied by 1.618 yields 7.85" (rounded up to the 8" width). A Fibonacci gauge (*above*, **More Resources**) will help you maintain that ratio when drawing plans.
- 2.** After determining the overall dimensions, look for ways to add dominant (prominent, figured, or thick parts that catch the eye first) and subordinate forms (subtle, plain, or thin parts) to your design. A chair with slats, seat, legs, and back all the same thickness has no dominant or subordinate form. Vary part thicknesses and widths for more visual appeal.
- 3.** View a completed prototype from all angles. Looking at it in three dimensions may reveal design shortcomings. For instance, though a chair may have an impressive profile, looking straight at it may reveal a surprisingly bland or blocky appearance.
- 4.** Once you've developed your design, add or subtract an element. If adding a decorative curve in a dresser's bottom trim or removing a mirror from atop it makes the piece less attractive, the design is probably complete.
- 5.** Finally, don't feel bound to design principles. Designer, craftsman, and *WOOD*® contributor Todd Clippinger says, "I'm not tied to numbers; I design by feel and trust my instinct."



## 2. Make a miniature

Even if it lacks the functionality of the real thing, a miniature helps convey your design concept to a spouse or client. A miniature also helps you fine-tune design elements, identify methods for—and the order of—assembly, and gives you your first real-world look at the project's shape and proportions. For supplies to make a low-cost miniature mock-up, look no further than your scrap bin (*right*), or desk drawers (*below*).



The general shape and design for this jewelry box was refined through the quick construction of a nonfunctioning miniature.



Design Editor John Olson used only a manila folder, tape, and paper clips to prototype—hinged wings included—the Quick-Convert Tablesaw/Router Station featured in issue 213 (Sept. 2012).

## 3. Tape up an outline

Once you've established a general design concept and an approximate idea of the project's size, lay out the project's footprint with painter's tape (*below*) to quickly convey its dimensions and presence to a spouse or client. If they or you still can't quite picture the finished piece, try the next strategy.

### TAPE OUTLINE SIGNIFIES SIZE



Mimicking the dimensions of your proposed project with painter's tape gives a sense of the space the project will fill.

## 4. For larger scale, prototype with packing material

Cardboard, foamcore, polystyrene foam (Styrofoam®), and rigid insulation are inexpensive, easy-to-work materials for quickly mocking up a full-size prototype such as the one seen at *right*. You can cut pieces to size with a utility knife or your regular woodworking tools, sand them to shape with rasps and abrasives, and join them with hot-melt glue or painter's tape.

Additional layers of material to mimic doors or frame-and-panel assemblies further refine the design. Or simply draw them on with a marker.

**Quick Tip!** As with your sketchbooks, don't throw out rejected prototypes. Even if the design isn't quite right, you may find the visual aid helpful in selecting elements you want to keep for the final project.

### CONSTRUCT WITH CARDBOARD



Designer, craftsman, and *WOOD*® contributor Todd Clippinger mocks up a full-scale fireplace surround from cardboard to help his client visualize the design.

## 5. Build a facsimile from secondary woods

Though foam and cardboard work well for constructing mock-ups, they don't help you determine a piece's strength and functionality, and making them gives you no insight into building techniques. For assistance in those areas, build a full-size prototype from an inexpensive wood such as poplar, birch, pine, or Douglas fir. For sheet goods, choose MDF, or plywood if structure and strength need testing. Don't worry about detailed appearance—you can disregard fine sanding—as much as practicing construction techniques and testing the functionality of the piece (*below*).

**Quick Tip!** When clamping your prototype, snap a quick photo with your phone. Review the photo before doing the same step on the actual project to help recall the best clamp configuration.

Though the *WOOD* designers approved the look of the Z Rocker in issue 208 (November 2011), they wanted to test the strength of the tenons joining the legs. Constructing a prototype of the leg assembly proved the chair would support more than enough body weight to work.

### PARTIAL PROTOTYPES HELP



A poplar prototype of this hand plane reveals more about the most comfortable and ergonomic shape than a nonwood material would.



## 6. Wait to fasten parts on the final project

With a prototype built, the design confirmed, and techniques practiced, you might think you're done. But even with the final parts cut out, you can still make final adjustments to tweak a project for the best look, fit, or feel (*right*).

Perhaps the best part of having constructed a series of prototypes isn't just the resulting polished final project, but having everything you need to replicate the piece time and again. 🌲

### CHECK FOR COMFORT



With this bench's back slats only clamped on, Design Editor John Olson invited fellow staff members of varying heights to take a seat as he adjusted the slats' locations for maximum comfort.

### More Resources

- ▶ Prototype on the computer with SketchUp. Learn the basics: [woodmagazine.com/sketchupsimplified](http://woodmagazine.com/sketchupsimplified).
- ▶ Download a free copy of SketchUp here: [sketchup.com/download](http://sketchup.com/download).
- ▶ Learn about the Golden Ratio and how to use a Fibonacci gauge here: [woodmagazine.com/fibonacci](http://woodmagazine.com/fibonacci).

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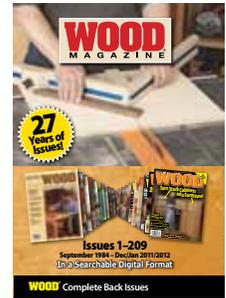
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