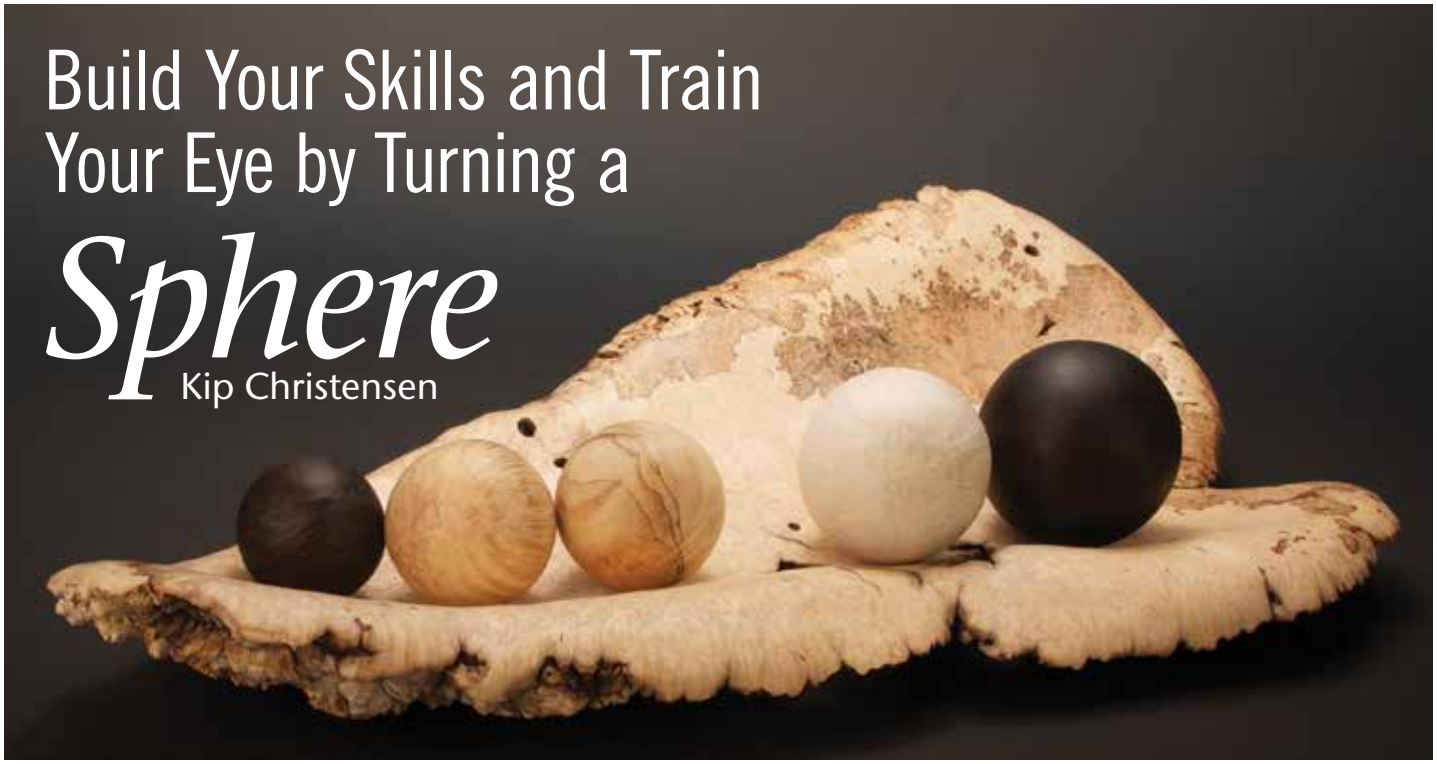
Build Your Skills and Train Your Eye by Turning a *Sphere*

Kip Christensen



Preston Christensen,
Ebaneet e Slanovaya Kost (Ebony and Ivory),
2009, Box elder burl, 5" × 21" × 12"
(13cm × 53cm × 30cm)

These box elder burl spheres were decorated using simple but effective methods. From left to right: turned green and ebonized, natural finish, spalted with natural finish, turned green and bleached, ebonized.

Photo: Kip Christensen

Spheres are fun to turn, provide an interesting way to display a collection of various woods, and make a wonderful pallet for unlimited surface decoration possibilities. After a little practice, they can be turned in about fifteen minutes. There are, however, two more significant reasons why spheres are productive and meaningful projects for turners.

First, making a sphere offers an excellent opportunity to build and hone a variety of basic turning skills. Most of these skills fall into the category of spindle turning, where the grain is parallel to the bed of the lathe. However, the process also calls for rotating the sphere 90 degrees, so the grain is perpendicular to the lathe bed, similar to most faceplate or bowl-turning projects. Further, when making final cuts to refine the shape of the sphere, the wood is often mounted with the grain oriented randomly in

Rough-turn the blank

1

To remove the square corners, use a spindle-roughing gouge to make several short cuts beginning at one end and progressing to the other end.

2

Make a series of cuts to remove the square corners until only the cylinder remains.

3

One or two quick planing cuts should remove any remaining flat areas left over from the roughing process.

relation to the lathe bed. All these changes offer you an opportunity to practice both spindle- and faceplate-turning techniques, while making one simple project.

Second, taking a chunk of wood that is square in cross-section and turning it into a ball requires the turner to practice one of turning's most common forms—the symmetrical curve. The ability to visualize and cut perfectly symmetrical coves and beads is an important skill for turners to develop.

Determine length

With outside calipers, the diameter of the cylinder can be quickly transferred to the wood to indicate the correct length of the sphere.

Begin the parting tool cut with the tool handle low to create a peeling angle. Raise the tool handle as needed while making the cut.

Mount and rough-turn

Turned spheres can range greatly in size. Here, I started with a piece of wood approximately 3" × 3" × 4½" (8cm × 8cm × 11cm). The size of the wood is not critical but the blank should be square in cross-section and one to two inches longer than it is square.

Mark the centers of each end and secure the wood between a drive center in the headstock and a cup-and-point ball-bearing center, or live center, in the tailstock. Adjust the toolrest parallel to the lathe bed, about ¼" (6mm) away from the wood, and slightly below center height. Rotate the spindle by hand to make sure the wood will not contact the toolrest when turning.

With the lathe at about 1500 rpm, turn away the square corners and flat surfaces until only a cylinder remains. A spindle-roughing gouge works well for this. With the tool handle low, turn using a peeling angle. Start the first cut about ½" (13mm) in from one end of the cylinder and cut toward that end (*Photo 1*). Cut deep enough to remove the corners and all or most of the flat surfaces. As you progress along the blank, begin the next cut about ½" away from the beginning of the previous cut. Continue by making several short nibbling-type cuts as you move from one end of the cylinder to the other (*Photo 2*). After the square corners are removed, take one or two planing cuts the full length of the blank to turn away any flat surfaces (*Photo 3*).

Layout key locations

With the lathe off, hold a set of outside calipers across the cylinder and adjust the opening until it is equal to the diameter of the cylinder. Next, turn the lathe on at a slow speed and transfer that distance to the workpiece by resting the calipers on the toolrest and pressing the legs of the calipers lightly against the spinning wood to create burnished layout lines (*Photo 4*). If needed, darken the layout lines using a pencil.

On the outside edge of the layout lines, make parting cuts down to about ¾" (19mm) diameter (*Photo 5*). Be sure to widen the cut slightly as you go to prevent the tool from binding in the kerf.

With a sturdy, sharp skew, remove the excess wood at each end of the blank. ▸

Remove waste, mark center

With the tool handle held low, the shavings do not need to change direction much as the wood is removed.

The peeling angle of the tool produces an efficient, clean cut.

A clearly marked centerline serves as a reference for shaping a symmetrical sphere. Cut from the center toward each end.

Rough-turn the sphere

Turn one half of the sphere by making several bead cuts. Begin by removing the excess wood at the corner of the cylinder.

Notice that near the end of the cut, the gouge will be rolled into a "closed" position, meaning the flute is pointing nearly to 3 o'clock.

Shown here is the profile of the right half of the sphere.

A small detail or spindle gouge is easier to control when cutting near the bottom of the bead than is a larger shallow gouge.

Shopmade Cup Centers

You can buy cup centers made from aluminum or plastic, but I prefer shopmade wood centers. I made mine using an arbor screw chuck for the drive (headstock end) and a revolving center for the tailstock end. These items are commonly available at woodturning supply stores. For the wood parts, I prefer a softer hardwood, such as poplar or soft maple, with the grain running parallel to the lathe bed.

Making the headstock piece, or drive center, is very simple. Start with a block of wood about 2" (5cm) square and drill a 3⁄16"- (5mm-) diameter hole about ¾" (19mm) deep into one end. Thread the wood onto the screw chuck. Mount the screw chuck (with the wood) in the headstock's Morse taper, turn away the square corners, and turn a shallow cove that has a smaller radius than the curve of the spheres you plan to make (*Figure 1*).

For the tailstock piece, mount another 2" block of wood on a screw chuck (or in a scroll chuck) and turn a hollow to fit snugly over the front-end portion of the revolving cup center. Use epoxy to glue the wood onto the end of the revolving center. When the epoxy has cured, mount the revolving center with wood in the headstock and tape the ball-bearing section to the Morse taper to temporarily disable its revolving action. Turn away the square corners of the wood, then turn a shallow cove similar to the one you turned for the drive center (*Figure 2*). Finally, remove the tape and secure the revolving center in the tailstock.

Figures: David Heim

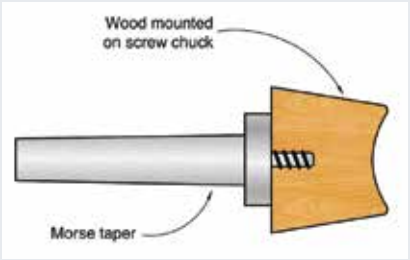


Figure 1. Use an arbor screw chuck for making the drive cup center, which will be mounted in the headstock.

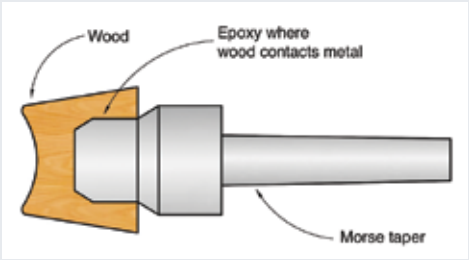


Figure 2. Use a ball-bearing revolving center for making the tailstock cup center.

A peeling angle works best for this cut. Lay the skew flat on the toolrest with the tool handle low and the cutting edge parallel to the lathe bed (*Photo 6*). As you advance the tool into the wood, lift the skew handle gradually to produce a ribbon-type shaving (*Photo 7*).

Use a pencil to mark a centerline between the ends of the blank (*Photo 8*). This line can be measured with a ruler or carefully eyeballed.

Rough-turn the sphere

Rounding the cylinder into a sphere can be done with a variety of gouges or with a hefty skew. I like to start with a ¾" shallow spindle gouge sharpened with a fingernail grind. This is a shearing cut made with the bevel gliding on the wood behind the cutting edge. Begin by gradually rounding the corners of the cylinder. Continue making bead cuts until the rough shape of one side of the sphere is turned. Turn one half of the sphere as accurately as you can by eye (*Photos 9–11*).

Then repeat this process to turn the shape of the second half of the sphere. As the cuts get closer to the ends of the sphere it is often easier to use a spindle or detail gouge rather than a wider shallow gouge (*Photo 12*).

Since it is not critical that the sphere be accurately shaped at this point, gauging the shape can be done by eye.

Remount using cup centers

After the sphere has been turned to rough shape, remove it from the lathe. Next, replace the drive center in the headstock with a cup drive center, and replace the tail center with a ball-bearing cup center (*Photo 13*). For drawings and instructions on how to make your own cup centers, see *Sidebar.*

Remount the sphere between the cup centers with the ends of the sphere perpendicular to the lathe bed (*Photo 14*). Using a spindle, detail, or small bowl gouge, remove the stubs that remain on the ends of the sphere.

Remount, remove stubs


13
Cup centers are simple fixtures used for holding spheres while turning.


14
Cup centers allow the sphere to be rotated and mounted in any orientation, which makes it relatively easy to refine the final shape of the sphere.


15
Before making the refining cuts, it is necessary to remove the stubs that were used to hold the piece between centers. Make sure the toolrest is far enough away for the stubs to clear. After removing the stubs, adjust the toolrest to within about ¼" of the sphere.

With the tool handle low, make light cuts from each side toward the center of the stubs (*Photo 15*).

As you cut the remaining stubs away, observe the rough-shaped sphere as it spins between the cup centers. You will probably notice a slight blur resulting from the sphere not yet being perfectly round. Look for the solid sphere shape inside the blurred surface and use it as a visual guide to help you refine the shape of the sphere.

Refine the sphere shape

At this stage, the sphere shape can be further refined using a series of shear-scraping cuts. Since the grain direction of the wood is now oriented perpendicular to the lathe bed (rather than parallel as when first mounted between centers), cutting "downhill" from large diameter to small diameter would result in cutting directly into the endgrain for much of the cut. To prevent this, cut into the sidegrain by shear-scraping from small diameter to large—in other words, cut "uphill." This may seem contrary to spindle turning practice, but at this point, the wood is oriented perpendicular to the lathe axis, as in bowl turning.

To make this uphill shear-scraping cut, rotate the bevel of the gouge away from and the flute toward the wood and start the cut near the cup centers. Take light cuts, working upward and outward toward the outside diameter near the toolrest (*Photo 16*). Repeat this process as necessary by rotating the sphere between the cup centers and turning away the high areas.

When the grain is oriented parallel to the lathe bed, make shearing cuts downhill (from large diameter to small) with the bevel gliding on the wood behind the cutting edge (*Photo 17*). When the grain is oriented askew to the lathe bed (neither exactly perpendicular nor parallel), use a shear-scraping cut, working uphill from near the cup centers outward toward the toolrest (*Photo 18*). ▸

Refine the shape


16
When the grain is oriented perpendicular to the lathe bed, make shear-scraping cuts "uphill" from small diameter to large. This allows cutting into sidegrain rather than into endgrain.


17
When the grain is oriented parallel to the lathe bed, cut "downhill" from large diameter to small, taking shearing cuts with the bevel gliding on the wood.


18
With the grain oriented on a bias, or askew to the lathe bed, treat the cut as if the grain is perpendicular to the bed and use a shear-scraping cut, moving "uphill" from small diameter to large.

Sand and finish

Once the sphere has been cut and is clean and accurate, it can be sanded. Move the toolrest out of the way, reduce the lathe speed if needed, and sand the sphere (*Photo 19*). Rotate the sphere between the cup centers as needed while you progress from about 150-grit to around 400-grit abrasive.

After the sphere has been fully sanded and is free of any tool marks or sanding lines, remove the sphere from the lathe and apply finish by hand. There are several finishes that work well. I usually use several coats of an oil finish such as Waterlox or Watco Danish Oil.

After turning a few spheres, you will notice your turning techniques improve and possibly have a few ideas for interesting surface decorations or other reasons for adding spheres to your turning repertoire. ■

All process photos by Stephanie Staples.

Kip Christensen is a professor of technology and engineering education who teaches wood prototyping, furniture design, and manufacturing at Brigham Young University. He has a particular interest in woodturning education and has authored several articles and DVDs on the subject. Kip's DVD, WoodTurning Projects with Rex and Kip, DVD #4, *includes the full process of turning a sphere; visit learningturning.com.*

Sand the sphere

During the sanding process, the sphere can be rotated and remounted several times in the cup centers while progressing through the various abrasive grits.

JOURNAL ARCHIVE CONNECTION

AAW's online journal archives contain more learning resources about turned spheres:

- **John Brewer offers another take on hand-turning spheres in the Summer 2001 issue (vol 16, no 2, page 26)**
- **Eugene Lee describes his shopmade sphere-cutting jig in the October 2012 issue (vol 27, no 5, page 42)**
- **POP's 2008 exhibition featured at the Richmond Symposium was called *The Sphere*; see a sampling in the Spring 2008 issue (vol 23, no 1, page 40)**

AAW members can access all past journal articles online at woodturner.org.

Decorate Your Sphere

Dick Gerard

Last year, I finished a year-long study of turning and decorating wooden spheres, thanks to a POP Fellowship Grant. My proposal was called, "Investigating Spheres in Woodturning," and I'd like to share with you one of the methods for embellishing spheres I explored under the Grant.

Assuming you have already made some spheres, what are you to do with them? If they are highly figured or have an interesting natural color, I advise doing nothing but applying the finish of your choice and letting the wood do the talking. On the other hand, if the wood is plain, perhaps surface enhancement or decoration is in order. Following is one easy technique you can use to add interest to any sphere: creating what I call harlequins—named for their varied colors.

Harlequins

Remount your turned sphere between cup centers, making sure it is centered so the added patterns will flow evenly. Of course, interrupted, or off-center, decorations do lend a certain dynamic to a piece, so precision is optional.

Begin making grooves around the sphere, spaced as evenly as possible. For cutting these grooves, I have used a three-point tool, the long point of a skew, and even the point of a spear-shaped tool (*Photo a*).

Next, I like to burn in these grooves using a burning wire to provide a barrier (and contrast) to any color you might add later. Add the burn lines before repositioning the sphere in the cup centers.

Rotate the sphere in the cup centers either 90 or 45 degrees—your choice, depending on the design you would like to achieve. Rotating 90 degrees will yield more square shapes (or rectangles), while a 45-degree turn will yield diamond shapes (*Photo b*).

Take the sphere off the lathe and add color to the separate boxes/diamonds (*Photo c*). To hold the sphere for coloring, a vacuum chuck or commercially available carving stand with a vacuum port is useful.

Dick Gerard has created a DVD on decorating wooden spheres. For more information, contact him at woodturn4@comcast.net.

In the Round:
A Gallery of Spheres

Stephen Hatcher and Dale Larson, *The Chase is On Gecko Box,* 2016, Bigleaf maple burl, calcite crystal, malachite, black mica, 4" (10cm) diameter

Dan Burleson, *Sphere,* 2015, Hard maple, 3" (8cm) diameter

Rüdiger Marquarding, *Schwarz,* 2014, Poplar plywood, redwood burl, 8" (20cm) diameter

Collection of Richard and Rita Goldberg

Photo: Rainer Erhard

Peter Rand, *Champagne,* 2016, Willow, 48" (1.2m) tall

Michael Malecki, *Globes,* 2016, Ash, walnut, maple, aluminum, turquoise, brass, 3½" to 5½" (9cm to 14cm) diameter

I purchased this turned wooden *boule*, or game ball, from a museum in Aiguines, France, near the Escoulen School of Woodturning. It was made there around 1930, along with many others. The 3½" (9cm) diameter *boule* is quite heavy and is made of boxwood root covered with metal nails for durability. It has the number 4 stamped on a little brass cap. *—Bud Latven*

Photo: Bud Latven