Speed Zone

By Alan Lacer

Reprinted with permission
American Association of Woodturners

When working small diameter miniatures, you really can raise the speed to fairly high levels. However, I was getting clean cuts on this 3/8" piece at speeds easily below 1,000 rpm.

What speed do I turn at? A number of years ago in an Arrowmont class, someone asked the instructor that question. After some thought, he responded, "Well I guess it should go around." What an insight!

On one level you might think the instructor was being a wise guy, but on another, he was close to the answer. You really can turn at a wide range of speeds and produce excellent work. However, there are a number of factors that a turner balances in choosing a speed, and this is why I have never been a fan of the speed-selection charts packaged with many lathes.

Diameters and rim speed

The rpm of the spindle is sometimes the least important number for me. No, the speed of the outside edge or surface may be far more telling in determining speed. (Comparison: the outer edge of a 10" table saw blade at 4,000 rpm is traveling at 119 mph, while the 1/2" router bit at 25,000 rpm is only travelling at 37 mph).

Look at the accompanying chart of rim speeds at different diameters and see the dramatic differences. A miniature running at 1,200 rpm may look like it is hardly moving, while a large bowl may overpower you and your lathe—which may place you in a danger zone.

Mass of the object

The real force of an object on the lathe is its velocity times its mass. So, a pen blank won't have a lot of force at 1,800 rpm—even if it flew off the lathe—while the 14-pound wet bowl blank at 1,800 rpm can be lethal. The higher the speed, the greater the force. At some very high rpm even the pen blank has real force.

Balance of the object

Look at what a few ounces of lead in the wrong spot on a front wheel of your car can do: A misplaced wheel weight causes your 2-ton monster to shake and rattle at certain speeds. We have the same problem in wood-turning: Out of round, inconsistent densities of the material, or pieces with voids all lead to excessive vibration at certain speeds. In reality, we may have some pieces that never balance—forcing us to work at slower speeds than we wish.

Stability of the lathe

This is related to everything I have already mentioned: Some lathes simply start shaking with almost anything mounted on them. Vibration is a curse to the machinist and the woodturner alike: We will have a rough ride, quality suffers, and safety issues abound if we don't have some degree of stability of the lathe itself. Also, some lathes have awful stands/legs, flimsy headstock spindles, headstock bearings that are too few, underbuilt or just too close together—all of these factors impact lathe stability and therefore the turning speed.

And one more factor: The low end speed of some lathes are simply not slow enough to do much bowl turning—they simply run too fast and are underbuilt. These are serious considerations in choosing a lathe if your interests are with bowls and vessels.

Now we are into a red zone: large diameter (17"), heavy, out-of–round/balance blank. If the lathe can handle such a piece, I progress from a point just below vibration to a modest speed as it becomes more balanced. However, with a rim speed of 51mph at 1,000 rpm, I never find it necessary to crank up much speed.

The skill of the turner

With NASCAR racing and woodturning, a true professional can often work at higher speeds. As your skill and control improve, you can turn at greater speeds. However, unless you are a production turner working on a piece-rate schedule, high speeds are not really the answer—so be careful here. Even production turners have had serious accidents related to speed. In most cases, folks don't really care how quickly you made something—only how well it turned out.

The material

I often hear it said that you get a better cut at higher speeds. True to a point, but in reality there are still other factors related to the material that affect the quality of the cutting action. The moisture content is one (generally the wetter the wood, the cleaner the cutting action), orientation of the grain as well as consistency in grain direction (cutting against the grain or grain that is wild and erratic causes problems), and species (compare the cutting qualities of fir against pear—they don't even seem to be related). Sometimes I do get a cleaner cut by raising the speed (you are getting more cuts per inch of travel)—but other times I get better results by not raising the speed and only slowing my feed rate (I move slower, and thereby get more cuts per inch of travel). And add to this the question of tool sharpness, working at higher speed becomes a smaller component of the equation. Finally, too much speed contributes to the problem of ribbing or chatter when the material flexes or distorts.

Recommendations for choosing a speed

Yes, there are many variables. First, be aware of the speed your lathe is set to even before you mount a piece or turn it on. Some serious accidents have occurred by not heeding this warning. Next, weigh all the factors for a particular piece on the lathe, especially diameter and mass. And the less stable your lathe and the less experience you have, get the blank as close to round and well centered before turning—this is primarily an issue in bowls, platters, vessels, and the like. For between center work, I saw off the corners when the diameters go above 4"; below that, a large roughing gouge handles the "out of round" safely.

It is always better to start at the slower speeds with a piece and gradually bring up the speed. This all raises the question: Can you turn too slowly? If the cutting action is choppy and labored, then speed up to the next level on your machine. If that next level leads to excessive vibration, you may have to live with turning at a slower speed. Always work at a speed that feels safe, controlled and comfortable for YOU. Finally, a sharp tool at the right cutting angle seems far, far more important than cranking up the speed to "do a better job."

SPEED OF LATHE-TURNED OBJECTS AT DIFFERENT RPM

RIM SIZE (outside dia.)	250 rpm	450 rpm	600 rpm	1,200 rpm	1,800 rpm	3,000 rpm
1/2" dia.	.4 mph	.7 mph	.9 mph	1.8 mph	2.7 mph	4.5 mph
6" dia.	4.5 mph	8.0 mph	10.7 mph	21.4 mph	32.1 mph	54.0 mph
12" dia.	8.9 mph	16.0 mph	21.4 mph	42.8 mph	64.2 mph	108.0 mph
14" dia.	10.4 mph	18.7 mph	25.0 mph	49.9 mph	74.9 mph	125.0 mph

Alan Lacer (www.alanlacer.com) is an *American Woodturner* contributing editor. He lives near River Falls, WI.