

# Sharpening Turning Tools: Some Fundamental Principles

by Lyn J. Mangiameli

This is a longer version of some comments I posted elsewhere. I'm putting it forward on its own and in this expanded version in order to foster some additional thought about the principles that underlie proper sharpening practice, and to call for us to then go on and test those principles in a scientific fashion. How sharp one wants their tools may be a matter of personal preference and technique, and how much one spends for a sharpening system may be determined by economic limitations as well as choice, but the principles underlying what is effective and optimal sharpening of woodturning tools can be (and to a great extent has been) determined objectively.

The questions frequently come up: How sharp should my turning tools be, and what is the best way to sharpen them?

In a sense, sharp enough is whatever matches one's sensibilities. I've seen people use tools literally as dull as a table knife, and despite the resultant bruising and tearout, those people were happy enough with the edge they were using. I've also read of Japanese workmen who would sharpen a plane blade after each stroke, just because they believed every cut should be made with a tool as sharp as it could be. So, I think there will never be consensus answers to the above questions, as decisions are made according to personal factors at least as much as science. Nonetheless, I would suggest that there are several issues worthy of consideration, whatever your particular approach to sharpening.

I consider four things to be important with respect to sharpening:

1. Determining and Obtaining the correct geometry
2. Repeatability of set up to maintain the geometry first established
3. Producing the least heat possible when removing metal
4. Producing the most consistent ("sharpest") edge appropriate to the work the tool will perform.

## Determining and Obtaining the Correct Geometry

Determining and obtaining the correct geometry is the starting point for all sharpening. If one does not choose the correct effective cutting angle, included angle, and shape, then one is not going to achieve optimal performance from the tool. Just what the correct geometry is will depend on tool and application, but there will always be some optimal geometry. See the books by Leonard Lee and Mike Darlow to explore the general theory behind this (there are others, but these are some of the more modern and accessible), and Jerry Glaser's article in the March-April issue of *Woodworker West* for excellent advice specific to sharpening gouges. A jig can be pre-set to achieve a specific precise geometry, and makes it more likely you will actually achieve the geometry desired. Having a stable vibration free grinding platform, and balanced trued wheels (if you are using grinding wheels) are also important to obtaining and retaining proper geometry.

## Repeatability of Set Up

Repeatability of set up to maintain the established geometry is highly desirable and will reduce your sharpening time, increase your tool life, and make the tool predictable in use. Renewing a dull edge actually requires removal of very little material, if you are presenting the tool precisely coincident to the existing geometry. Free hand sharpening will never allow for optimal repeatability, while jigs such as those that come with the Tormek, Jerry Glaser's, the Woodcut Tru-Grind, Kelton and Oneway Wolverine, among others, make it much more likely you will repeat the original geometry of the tool. To quote Jerry Glaser, who has probably ground more gouges than anyone, "...it's difficult-even with the aide of a tool rest-to reposition the bevel against the face of the grinding wheel exactly the same way each time, if you are doing it free hand. The usual result is a bevel composed of many facets, some of which may actually affect the edge. To compound the problem, the shape of the bevel gets altered with each trip to the grinder, so that in a short time, it barely resembles the original shape. And with a multi-faceted bevel, it is difficult, if not impossible, to hone the resulting edge properly. When the tool gets dull, the only recourse is another frustrating session at the grinder, and more expensive tool steel turned into grit on the floor." While with a repeatable set up, "...you now have a bevel that can be easily honed because the edge and heel are clearly defined. You will also have a tool that behaves the same through all its sharpening cycles. And the tool life is extended."

## Producing the Least Heat

Producing the least heat possible when removing the metal is well established principal among users of hand tools, but is often ignored or overlooked by turners. Certainly high carbon steel can easily lose its temper when exposed to high heat, but HSS and other "exotic" alloy steels are not immune to ill effects. Serious Lathe, makers of A-2 steel tools, posts this caution from their steel supplier, Latrobe Steel: "Improper grinding techniques can affect the performance of high speed steel tools not only by the formation of grinding cracks and eventually breakage but also by the development of a softened surface zone. In many cases the visual appearance of this softened zone is deceptive since the amount of visible burning often appears very slight yet the microscopic effect can be shown to progress a considerable distance below the surface with consequent deleterious results on tool performance. This fact is particularly important to keep in mind when subsequent grinding/polishing operations remove the visible burn color by a very shallow grinding pass." So how does one reduce such heat? Four ways:

A. Remove the least amount of metal necessary, as David Ellsworth likes to say, "Don't Grind the Tool, Dress the Bevel." (If you are going to be removing a lot of metal, use a coarse abrasive. Jerry Glaser

actually uses a 46 grit stone, but for most something closer to a 60 grit is preferable.)

B. Use an abrasive with sharp edges. (For a grinding wheel make sure it is a friable stone dressed often to reveal sharp edges; for sanding belts or disks make sure you replace them regularly.)

C. Apply minimal pressure.

D. Remove the tool frequently to allow it to air cool, or better yet, use a wet grinding system. (However, don't dip a dry ground gouge in water. To quote Glaser again, "a water quench cools the thin edges of the tool much more rapidly, causing them to shrink more than the bulk of the tool and the edges may develop small cracks as a result." One can see a picture of this in Leonard Lee's book.)

As can be seen from the above, just reducing the speed of the abrasive moving past the tool (i.e., a slow speed, 1750 rpm grinder or sander) does not guarantee cool grinding-there are many other factors that together are much more significant.

## Producing the Most Consistent Edge

Producing the most consistent edge appropriate to the work the tool will perform. What I mean by this is how regular is the edge. An edge formed off a coarse wheel may well have the intersecting angles be sharp, but the edge will be uneven due to the uneven surface of the stone, thus leaving an edge that looks, at best, like this V VVV VV VV V. An edge that is formed on a fine grit wheel will have a surface more like this vvvvvvvvvvvvvv. The tips of the V's may be equally pointed, but there is more side support to the more closely and evenly spaced tips. The widely spaced coarser V's are going to heat more quickly, and will break down more quickly. This is in part why a "sharper edge" (which might be better called a finer edge) will actually be longer lasting than a coarser edge. The effect is actually more pronounced than the example implies as the variation is really in three dimensions rather than the two shown.

The importance of a refined edge (and indirectly, the other factors listed above) was actually tested by Robbie Farrance several years ago and was presented in *Woodturning Magazine*, Issue #70. Farrance compared the edge obtained off an 80 grit white wheel followed

by honing with an Arkansas slip stone against an edge obtained using the Tormek. Using a sample of 16 pieces of wood, equally divided into hard wood and soft wood, he measured how much wood could be removed by the tools in a measured time, over a measured distance, giving a resultant depth or volume of wood removed. What he found (and displayed through graphs in the original article) was that the Tormek ground tool "was performing better than the dry ground, both in terms of durability of the cutting edge and the finished surface of the wood—the wet-ground tool gave the best results on a consistent basis, and far outlasted the dry-ground tool in terms of durability." In his conclusions he wrote: It's generally assumed that using a slow-running water-cooled system will be time consuming, but this turns out to be more supposition than fact—the evidence suggests that using a wet-grinding method gives a sharper edge and cleaner cuts with more than double the effective turning time between sharpenings...even after 18 minutes of continuous turning in softwood, the well ground tool was still cutting more than three-and-a-half times faster than the dry ground tool." What I would say here is that it is likely his findings are not representing wet vs. dry grinding so much as it is demonstrating the advantages of preparing your turning tools consistent with the principles I have described above.

What this adds up to is that precision and repeatability are major factors (but obviously not the only factors) in achieving the optimal balance of tool life, sharpening time, and performance. For me, this means using a Tormek for almost all my tool edge maintenance, and using a jig like the Woodcut Tru-Grind or Kelton with a coarse wheel for initially establishing any changes in geometry. One obviously doesn't need to duplicate my system to obtain a usable edge, but I would offer that the more your sharpening method adheres to the principles delineated (which the above system does so well), the better will be your cuts, the longer your tools will last, and the less time you will spend sharpening.

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