Sharp and Sharper

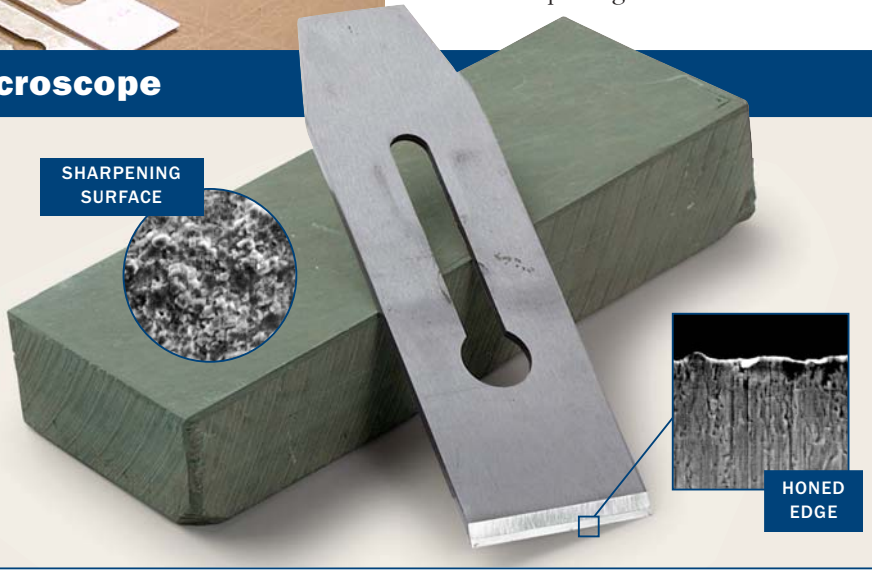
Nine honing systems are put to the test

BY AIMÉ ONTARIO FRASER

Learning to be a better woodworker means learning to be a better sharpener. That's a simplification, of course, but sharpening is so fundamental to fine woodworking that the two are bound together like a double-wedged through-mortise and tenon glued with epoxy. And just as woodworkers have strong opinions on how to cut, wedge and glue that joint, they have strong opinions about sharpening. Ask six woodworkers

Under the microscope

Abrasives vary widely, with various designations for grade or grit, but 700x photos put the systems on a level playing field, matching them up in terms of results. Each blade was honed on the successive series of grits recommended for each system, finishing on the finest grit available.



Photos, except where noted: Michael Pekovich; facing page (bottom): Asa Christiana

THREE POPULAR SYSTEMS

The grit size of each abrasive is apparent in the microphotographs, as is the scratch pattern on the honed edge. In the handplaning test, the roughest edges gave adequate results, but the finest edges performed superbly.

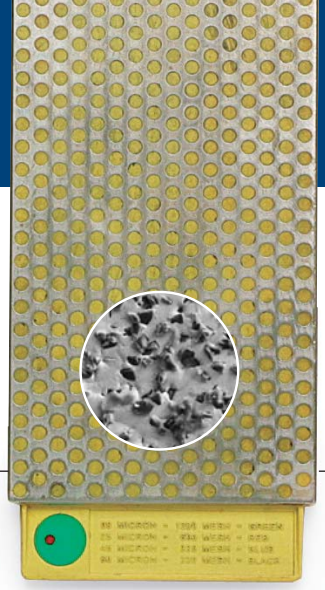
ARKANSAS STONE

Finest grit: Translucent

Source: Woodcraft (800-225-1153)

Price: $159 ($273 for set of four grits)

Use: With light honing oil; flatten occasionally on coarse diamond stone or sandpaper



DIAMOND STONE

Finest grit: Extrafine

Source: Woodworking catalogs

Price: $85 for combination stone

Use: Mist with water

WET-OR-DRY SANDPAPER ON GLASS

Finest grit: 2,000

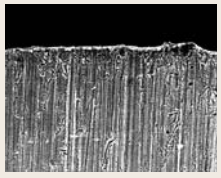
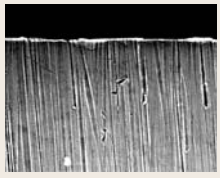
Source: Auto-parts stores

Price: $1 per sheet

Use: Attach to glass with spray adhesive; mist with water

SHOP TEST SCORING THE SYSTEMS

Fraser rated the honing systems in three ways. Ease of honing took into account how quickly the abrasive cut and how easy it was to use. Ease of planing was based on planing three woods: quartersawn hard maple, tiger maple and end-grain cherry. Last, she evaluated the surfaces produced on those woods.

MICROPHOTO OF PLANE IRON			
ABRASIVE	**Arkansas stone**	**Diamond stone**	**Wet-or-dry sandpaper**
EASE OF HONING	Good	Excellent	Very good
EASE OF PLANING	Fair	Good	Good
WOOD SURFACE	Good	Good	Good
COMMENTS	Abrasive cut slowly; a great deal of pressure was required to plane tiger maple and end grain; left heavy scratches on end grain	Left very good surface on straight grain but slight tearout on tiger maple and small scratches on end grain	Left surface good enough for light sanding on straight grain but tearout on tiger maple; good value

about the best way to sharpen, and you'll get at least 10 different answers.

Those varied answers never sat well with me, and I wanted to know what worked best and why. So I undertook an evaluation of the most common methods of sharpening woodworking tools. For this test I focused on plane irons—because it's easy to control conditions and evaluate results when planing—knowing that the bottom-line results would be the same for chisels, spokeshaves and other edge tools.

After spending a few months immersed in the subtle art and science of sharpening, I can see why each method has its proponents. Every method I tested produced adequate results—consistent plane shavings and flat surfaces. But some methods are better than others, yielding a superior finish when handplaning, with less effort.

To do these tests, I flattened, polished and honed the plane irons on each abrasive system. I tested diamond stones, Arkansas stones, wet-or-dry sandpaper, various waterstones, micro-honing compound on a leather strop, the Tormek system and diamond paste on various substrates. Then I looked at the blade edges and the abrasives at 700x magnification. I also used the blades in the shop for

Microphotographs: Mark Floyd, Forensic Analytical Labs

WATERSTONES

Not all waterstones are created equal. The quarried and synthetic Japanese stones vary widely in price but less so in results. Unlike other waterstones, the Norton does not need to be soaked in water and is softer.

QUARRIED JAPANESE WATERSTONE

Finest grit: 8,000 (stone is called Awase Toishi, Grade 7)

Source: Japan Woodworker (800-537-7820)

Price: $225 ($279 with medium natural stone, called Aoto, and Nagura stone)

Use: Soak in water, then rub with Nagura stone before use; flatten occasionally with diamond stone or sandpaper

SYNTHETIC JAPANESE WATERSTONE

Finest grit: 8,000

Source: Various woodworking catalogs (brand name is Samurai)

Price: $77 ($135 for set of four grits)

Use: Soak for at least 10 minutes before using; flatten occasionally on sandpaper or diamond stone

NORTON WATERSTONE

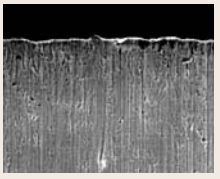
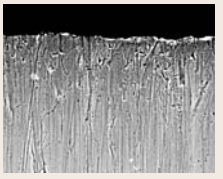
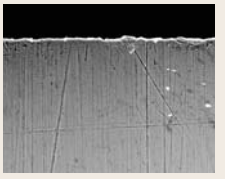
Finest grit: 8,000

Source: Garrett Wade (800-221-2942)

Price: $98 ($193.60 for set of three grits)

Use: Mist with water; flatten frequently on diamond stone or sandpaper

A Nagura stone is recommended for the quarried waterstone. *Rub the soft, chalky Nagura on the waterstone to condition it for final honing.*

MICROPHOTO OF PLANE IRON			
ABRASIVE	**Quarried Japanese waterstone**	**Synthetic Japanese waterstone**	**Norton waterstone**
EASE OF HONING	Excellent	Excellent	Excellent
EASE OF PLANING	Excellent	Good	Excellent
WOOD SURFACE	Very good	Very good	Excellent
COMMENTS	Planing was easy; left smooth surfaces except just a few stripes raised slightly on tiger maple	Planing was difficult at times; left some roughness on tiger maple	Very easy to use; plane iron left a mirror-smooth surface on all three woods, with no tearout on tiger maple

daily work and in controlled tests. When it was over, I knew sharp—both in theory and in practice. I could see it in a microphotograph, hear it as I worked the irons on the stones and feel it through the plane on tiger maple.

What makes a good edge

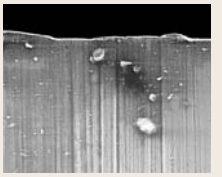
To understand why some edges cut better than others, you need to understand the edge. The edge of a plane iron is the intersection of two surfaces: the back of the iron and the bevel. When the back is flat and smooth, it presents a straight line to intersect with the bevel. Likewise, a bevel honed on a flat stone presents a straight line. When these two lines intersect, the edge is flat and smooth.

At the other extreme, a back with a hollow at the edge and grinder marks from manufacturing presents a curved and jagged line. A bevel honed on a coarse stone does likewise. The intersection of these two poor surfaces is doubly serrated, with random peaks and valleys that break and tear the wood rather than slice it cleanly. Also, the peaks break off inconsistently, and within a few inches of planing the iron becomes even more jagged and dull. This breakage on a microscopic level is the reason why the plane irons sharpened on some abrasives left obvious scratches by the time they got to the end-grain test.

Woodworkers generally hone their chisels and planes with a bevel angle around 30°. The angle isn't critical, but it must be maintained during honing. Any wobbling rounds the bevel and means each subsequent grit of abrasive may not be reaching

BUFFING COMPOUND AND TORMEK SYSTEM

The leather strop with microhoning compound is intended to be a final honing step only, so Fraser first honed that blade on the diamond stones. The Tormek, on the other hand, markets itself as a complete sharpening system, recommending taking a blade directly from its wet grinding wheel to its leather wheel charged with buffing compound, a jump in grits that may explain its rougher results.

MICROPHOTO OF PLANE IRON		
ABRASIVE	Buffing compound on leather strop	Tormek system
EASE OF HONING	Excellent	Good
EASE OF PLANING	Very good	Good
WOOD SURFACE	Very good	Good
COMMENTS	Left glassy finish on straight and end grain but tearout on tiger maple	Good on straight grain; hard to plane tiger maple; screeched on end grain; blade edge was rolled over slightly in microphotographs

BUFFING COMPOUND ON LEATHER STROP

Finest grit: Green, microfine

Source: Woodcraft (800-225-1153)

Price: $20 (plus $22 for bench strop)

Use: Rub compound on split-leather strop before honing

the very tip. After 25 years of boatbuilding and furniture making, I can get decent results with freehand honing, but for the best edge I use a honing guide.

It takes more effort to push a plane with a dull iron. The iron wants to skip over the wood, and it takes a great deal of downward pressure to cut a continuous shaving. And even with that pressure, the cut is rough with significant tearout.

A sharp plane iron lasts longer and slices wood cleanly, producing beautiful, even shavings with almost no downward pressure after the first few inches. It will leave a glassy smooth surface in all but the most difficult woods. A sharp chisel or gouge will pare a finer, more accurate shaving and give you more control in end grain.

For consistency, I tested identical plane irons, prepped the same way

To put all of the sharpening methods on an equal footing, I started with a couple of dozen identical, unused Lie-Nielsen plane irons, made of standard carbon steel. I had the backs ground flat at a machine shop, then lapped them all by hand using materials and methods common to woodworkers, not machinists: I polished each iron for about 40 minutes on a series of soft steel lapping plates charged with 9-, 6-, 3- and ½-micron diamond paste (the smaller the number, the finer the grit). By the way, a micron is one millionth of a meter.

TORMEK GRINDING AND BUFFING WHEELS

Finest grit: 6,000

Source: Various catalogs

Price: $412 for system (with grinding stone)

Use: For initial grind use grading stone to roughen wheel and then to condition wheel to a finer surface; use honing guide with both grinding and buffing wheels

To evaluate each sharpening system, I purchased sets of the various grits. The grades and grits of each system don't compare perfectly. I treated each system on its own terms, following the recommendations of the manufacturer, finishing on the finest grit available.

I used a FastTrak Honing Guide to hold all of the irons at a consistent 30° angle to the stone. (For more on honing routines and systems, see p. 41.) Last, I cleaned and oiled each iron and put it in a cardboard sheath to protect the edge in transport.

One set of irons went to a lab, the other to the shop

I honed two irons with each system. One set went to Forensic Analytical Labs in Hayward, Calif., to be photographed through a scanning electron microscope, which provides clear images at greater magnification than an optical microscope could provide. I used the other set of irons in my daily work, getting real-world experience with

DIAMOND PASTE

As with buffing compound, this is a final honing step only. Woodworkers advocate a number of substrates for diamond paste, so Fraser photographed and tested blades sharpened with paste on MDF, hard maple and a steel plate marketed for this purpose. Maple was the winner, with the steel plate producing the roughest results. MDF was hardest to use.

DIAMOND PASTE ON HARD MAPLE

Finest grit: 0.5 micron

Source: Beta Diamond Products (800-975-9009)

Price: $30 (sold only as a set of various grits)

Use: Maple must be flat; use only one grit per wood block; isolate blocks and grits in plastic bags

MICROPHOTO OF PLANE IRON	
ABRASIVE	Diamond paste on hard maple
EASE OF HONING	Very good
EASE OF PLANING	Excellent
WOOD SURFACE	Excellent
COMMENTS	Smoothest edge in microphotographs; left the glassiest surface on wood with the least effort but was fussy to use; great final step after any other abrasive

Using diamond paste

A dab will do. *Apply the light mineral oil lubricant (above) and lay down diamond paste on only a small area of the substrate (right). Spread it out with your fingertip.*

Polish to a mirror surface. *Diamond paste is a great final step, no matter what honing system you favor.*

the ins and outs of each method. When the first set came back from the lab, I touched up each edge and then ran some controlled planing tests. The first was to plane quartersawn, straight-grained hard maple. I used a digital caliper on the shavings to set the cutting depth at 0.0015 in. Next, I planed a board of tiger maple, taking care not to skew the plane. Then I moved on to some end-grain cherry.

I ran the series of tests twice on each blade, checking my results and sometimes comparing two irons one after another to clarify subtle differences.

How the honing systems stack up

Though it's not the most sensational story ever, the truth is that for general woodworking—where you use planes and chisels for jointing edges for glue-ups, leveling and aligning subassemblies and paring and fitting joints in even-grained woods—every sharpening method is adequate if applied correctly. You'll get good results, especially if you're used to sanding your work before finishing it. If you're not getting perfect shavings with any of these abrasives, look at your sharpening technique (see the top story on the facing page).

For general work, as described above, wet-or-dry sandpaper on glass is the best value. It's fast, easy and inexpensive, at least in the short term. Diamond stones also produce a good edge just as quickly, though they are more costly. On the other hand, one set should last most of your woodworking life. A side benefit is that both sandpaper and diamond stones can be used to flatten other stones.

While the Tormek grinding and honing system left rougher results than some others, many woodworkers use the wet, slow-speed grinding wheel, with its many handy jigs, as a first step before switching to other honing systems.

For those who sharpen planes and chisels a lot or work with dense or highly fig-

A honing routine for razor-sharp results

1. The first step in honing any blade is flattening and polishing the back. Start with a coarse but dead-flat abrasive. This crucial step can take up to an hour, but it is a one-time investment. Then work through the grits, making sure each abrasive surface is flat. Finish by polishing the back on the finest abrasive you have. Shoot for a mirror finish.

2. To hone the bevel, secure the blade at 30° in a honing jig. Start on a stone that's two or three grits below your finest. When you feel a burr along the full length of the back, you've spent enough time on the coarse stone. From this point, it's merely a matter of polishing. In general, this takes less than a minute per stone.

3. Finally, hone the back of the blade on the finest grit to remove all traces of the burr.

Watch it on the web

To see a video of the author using a honing jig and diamond paste, go to www.finewoodworking.com.

ured wood, waterstones are the best bet. Blades sharpened on waterstones cut figured wood very well, and the stones are easy to use. Waterstones cut quickly and easily because the abrasive surface breaks away rapidly, continually exposing new abrasive. The downside is that waterstones need to be flattened often.

The Norton waterstones got the highest rating in these tests. They produce an edge that leaves a glassy surface under a handplane, with a minimum of effort. Although the quality of surface they produced was just slightly less than that produced by the diamond paste, waterstones are easier to use. There's no oil to attract and hold contaminants, as there is with diamond paste, and you just keep them in a bucket of water, always ready to go.

Synthetic Japanese waterstones, the most economical waterstone, did quite well in the tests—no tearout in tiger maple, just a bit of roughness. The costlier quarried stone, prepared in the traditional way by rubbing it with a Nagura stone before final honing, gave slightly better planing results than the synthetic one. However, my informal tests suggested that synthetic stones also perform better when prepped this way. And because a Nagura stone is inexpensive, it's a good way to upgrade.

When you need the very finest edge—such as when flattening a tabletop or working difficult woods—add diamond paste on maple as a final honing step. You will get a glassy-smooth wood surface that has no need for sanding. For the ultimate hand finish, pick up a handful of shavings and burnish the newly planed wood. Rub on oil and wax, and the wood will glow. You may need more than one grit of diamond paste, depending on the stone you finish with. For instance, 2,000-grit sandpaper is comparable to about 6-micron paste; step through the grits of diamond paste from 3 to 1 to ½ micron for the best finish. After an 8,000-grit waterstone (about 3 microns), go from 1- to ½-micron paste for best results.

By studying the photographs and the charts, you'll understand what goes on in sharpening. And you'll learn what you need to do to get from where you are to where you want to be. Bottom line—you'll be a better woodworker. □

Aimé Ontario Fraser is a woodworking teacher and writer in Westport, Conn.

MY IDEAL HONING SYSTEM

In my shop, I use Norton waterstones (center) for most sharpening. In demanding situations, I go through the trouble of getting out the diamond paste and maple (right) to polish both sides of the edge to a mirror finish. I also use diamond stones (left) to keep my waterstones flat and to rapidly flatten the backs of new plane irons and chisels.

Photo, this page (top left): Asa Christiana