



# Thinking grain

This month, **Kurt Hertzog** shares the importance of understanding the material you are working with and how, as a woodturner, you should always be ‘thinking grain’

On the path to truly master any craft, an artisan must come to thoroughly understand their medium. The intricacies of the process are key but in order to excel, the craftsman must be able to capitalise on the materials. This includes not only the characteristics that enhance the final result but also those material properties that can haunt them later on by creating some kind of a failure. That failure can be short term or long term.

The newcomer to the woodturning community often begins their journey with the seemingly daunting task of understanding the machinery, tools, needs and methods of sharpening, proper tool presentation, and the ‘mechanics’

of woodturning. The understanding of materials is often further down the list. When woodturners do add to their knowledge base on woods, it is often only species identification and perhaps finishing products that work well with their few favourite woods. Helpful but often insufficient effort is put into learning the common yet critical properties that all woods share. The understanding of wood and its inherent positive and negative features is critical to mastering the craft. The three most important reasons for the woodturner to understand and pay attention to the grain of wood are dimensional changes, cutting characteristics, and the effects on finishing. Simply said it is ‘understand your material’

and a wise woodturner will always be ‘thinking grain,’ as I will go on to show you in this article.

## KURT HERTZOG



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## UNDERSTANDING WOOD GRAIN

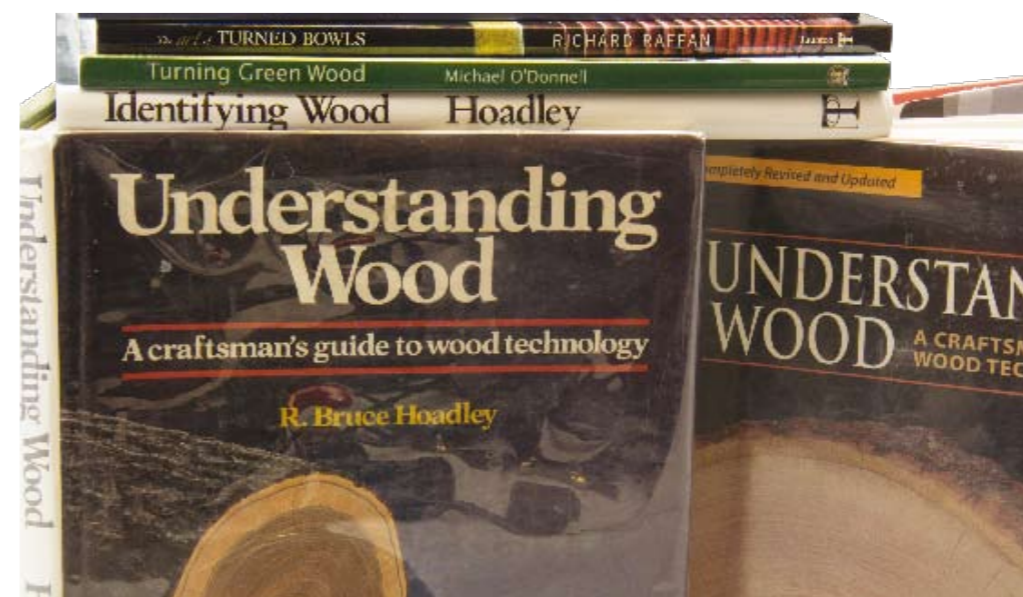
There are many information sources about wood written by woodturners, cabinetmakers, dendrologists, and others but the one that jumps to my mind is *Understanding Wood: A Craftsman’s Guide to Wood Technology* by R. Bruce Hoadley (2000). That book has far more information about wood than the average woodturner will ever need to know. You can delve into understanding wood to the level you wish. It has all of the key information presented in an understandable format. If you don’t have a copy of your own, locate a copy to borrow whether from a friend or your local turning club. It would be unfortunate if your turning club’s library didn’t contain a copy of this superb reference for the members to share. Bruce’s book will enlighten hobbyists to the

professional with information needed to take advantage of the characteristics of all woods. More importantly, it will help the woodturner learn how to prevent catastrophes that can occur by not having a sound understanding of the medium.

Accept the fact that wood will continue to take up and give off moisture as needed forever and move dimensionally during that process. Finishes added for beauty or protection will not prevent the wood from obtaining this equilibrium. Depending on the finish, the coverage, and the characteristics, you can sometimes have a slowing effect on rate of the take up and giving up of moisture but can never stop it. With sufficient time, it will always come to equilibrium with its local environment.



Regardless of your turning endeavours, both the faceplate and spindle turner will be faced with understanding and working with the grain. Each species has its own characteristics



Understanding your material is key to your success. Many books have sections that will give some of the basics. The most comprehensive on the subject of wood characteristics is by Bruce Hoadley



No finish can prevent the changes in wood based on moisture. The Corian nib to wood fit in both of these pens show the shrinkage of the wood during the winter changing to a less than perfect fit

◀ DIMENSIONAL CHANGES

All woods share the characteristic of dimensional change in three different directions. The percentages vary considerably between species. It expands and contracts for the entire life of the turning based on what the current environmental moisture content is. The change along the length of the grain is usually negligible and can be usually be ignored. The expansion and contraction radially – think of thickness – and tangentially – think of around the outside of the tree as tangential – is far greater than lengthwise and should be considered in each turning. Perhaps unimportant but you should always make that determination from a position of understanding rather than have it cause you problems because you neglected to consider it. Remember the door or drawer that works smoothly during the winter and sticks during the summer. Few locations anywhere in the world go through the year without some appreciable humidity change. Perhaps it isn't the seasonal change that will cause you problems but the change in final location for the turning. Turn the lidded box in your workshop and sell it to a customer in the desert southwest of the United States. The opposite can occur when turning and fitting things in your drier season and sending it to the customer located seaside or a moister

environment. Even if your turning will spend its entire life in your own locale, you certainly need to know that the wood will indeed move and plan appropriately if any of the movement dimensional changes will have a detrimental impact on your turning joinery, look, or functionality. Some woods move a lot and some very little. Knowing what your wood is going to do is worth understanding to avoid unpleasant surprises.

Letting wood move dimensionally is an artistic opportunity for many turners. Turning 'green' wood, wood that has been recently felled or waxed to slow drying, is not only very enjoyable but allows the turner to enjoy the dramatic movement of the wood. While usually only two axis move constrained by the third, the changes can be dramatic. Some species are notorious for their movement and twisting. Capitalising on the drying changes, the turner can use the grain orientation, end, face, or cross grain, to their artistic advantage. If the final goal is a round bowl, the first turning of 'wet' wood needs to plan for the shrinkage so sufficient material is left for the second turning after drying. Thinking grain will tell you that

an end grain bowl will not dry and shrink the same amount and directions as a face grain bowl. Use the knowledge to your artistic advantage.

Those who have interfacing or bonded parts in their turnings need to be very aware of grain orientation and potential movement problems. An end grain lidded box may work properly year round but a face grain lidded box will certainly change the fit over changes in relative humidity. Plan for it. Those that create multi-piece blanks or final assemblies by adhesively bonding wood are particularly susceptible to grain issues. End grain to end grain joints are almost universally avoided because of poor bonding strength. An end grain to face grain adhesive joint is usually destined to failure because of wood movement. Most craftsmen try to avoid this joint as well. Even face grain to face grain bonds can be failure prone if they are made with different species that have sufficiently dissimilar shrinkage rates. Each wood has its own moisture change rates for each axis. Segmented turners know this by heart or learn it the very hard way. Don't let it surprise you.

It is mathematically predictable for the most part. Be aware of what is going to happen and plan accordingly!

Even wood that is considered 'dry' may not be. Depending on the moisture level at various stages of turning and re-turning, there still can be some movement. Orientation can make it symmetrical movement or irregular

Species, dryness when turned, grain orientation, wall thickness, rate of drying and turned shape can all have an impact on the final result. Knowing about your wood and planning its orientation can prevent unwelcome surprises



Every species has its own moisture coefficients in all three axis. The longitudinal, radial and tangential all interact with each other. The grain orientation in the piece will determine what the effect is



Turning green wood – or less than dry wood – can be used to your advantage. The twisting that will be created with drying can provide some interesting effects. The species, thickness and grain orientation decide the results



The end grain to end grain joints in the bottom of this segmented bowl didn't fare nearly as well as the face grain to face grain joints elsewhere in the turning

A different bottom treatment, avoiding end grain to end grain joints, in the bottom of this segmented bowl has worked much better. Attention to grain orientation is as important when gluing as when turning



Of course, sometimes the rules can be broken or at least bent a bit. This multi-species glue up with all different grain orientations only survives – 12 years so far – because of the thin wall thickness. Thicker would likely fail



The bowl from a board, a glue of flat stock to create the bowl blank, can yield some interesting results. Since there is a variety of grain orientations and surface glue ups, results can vary

CUTTING CHARACTERISTICS

The grain orientation of your project will have a dramatic effect on your tool selection and the cutting characteristics of that tool. Hollowing an end grain bowl will be different than the more common face grain bowl. A partially canted or more cross grain bowl will behave differently. The ability to scrape versus cut and where it can be safely and effectively done will depend on the grain orientation at the various locations. Most times, the turner has oriented the blank to exhibit the beauty of the wood. Having done that, the turner does need to select the tools most suited to that grain orientation for their processing. Cutting 'downhill' still applies.

Most turners think little of sanding. It is relegated to the necessary evil category. It is usually used inappropriately to try to cover less than optimal turning as opposed to the real purpose of preparation of the surface for

finish. Regardless of your situation, sanding is a cutting process.

It is indeed a large number of small cutting edges that are bonded to the sandpaper backing for your convenience of use. Know that face grain sands better and faster than cross grain or end grain. Being careless with this fact will yield varying wall thicknesses telling all you sanded your project into submission. Like all tools, sharp tools work well and dull tools don't. When your sandpaper is spent, throw it away and get fresh. Worn out or clogged 220 doesn't become 320 grit. It is rubbish so dispose of it. Slow speed works better than fast. Fast only makes the cutting edges hop over things and friction builds up heat. Slow things down and keep the cutters in contact and doing their work. Your fingers will thank you and your turnings will appreciate the absence of the added heat.



Sandpaper needs to be treated like every other cutting tool. Keep it sharp; that means throw it away when it has been spent. Go slow enough to keep the cutting edges in contact and cutting

## ◀ EFFECTS ON FINISHING

When learning about woodturning, most of us come in contact with the soda straws analogy of how the grain strands of wood are situated and work for the benefit of the growing tree. That straw analogy is often used to explain why the turner should cut 'downhill'. It is also very useful in the explanation of shrinkage axis. Rarely is the turner exposed to the effects that grain has on the finishing process. Woodworkers learn this early in their endeavours but woodturners sometimes never really understand or appreciate the significance. If the ends of the grain are straws in essence, won't end grain suck up the finish far faster and in more quantity than face grain? Of course it will. Will it matter? It depends. It will depend on the finish you are using and whether you are using colourings. There isn't an answer that is universal. The turner should only be aware that the grain orientation might have an impact on the finish application and the final result. The sheen of the finished product will sometimes vary based on the grain orientation and certainly the preparation for the finish application.

Before committing, it is often beneficial to apply your finish to a smaller trial piece of the same species of wood prepared the same way. It would be a shame to finish your piece only to be disappointed in the final result. Trying out things on a sample piece of the same wood will

let you see the final result before you commit. A wise investment until you have determined what the desired process and finish is that will please you. Woodworkers often use sanding sealer to control the straw effects of end grain. The application of sanding sealer will slow the rate of absorption of the dyes, stains or finish to keep it visually comparable to the other grain orientations. This is very important prior to the application of stains or dyes to keep the colouring variations to a minimum. Controlling the penetration and effects is easily managed so don't leave it to chance. Turners don't often use this method but it is certainly applicable.



The turner often is taught about grain in wood with a straw analogy. It is very useful to understand not only the cutting downhill concept but also to know why there is a varying stain and finish take up of turnings



Used more often on spindle turnings, sanding sealer can help slow the fast end grain take up to help minimise colour variations. Notice the 50/50 thinned mix to help with cutting difficult grain. Clearly mark transfer container contents

## CONCLUSIONS

Thinking about the grain should be an ongoing process for the turner. It starts with the project planning. What are you planning on making and how do you want the grain to run? What impact will that grain orientation have on the design and the process? How will it impact the workholding? Glue ups? Appearance of finish? A tenon on a face grain orientated bowl will certainly have different strengths than a tenon on an end grain orientated bowl. Knowing the desired

grain orientation certainly will help before going to the wood storage bin or the local wood source. Now the sizes and shapes that lend themselves to the project can be selected.

The turner can not only potentially avoid unplanned failures but can take advantage of grain. A thin walled, natural edge bowl turned green from a fruitwood and allowed to twist and contort during the drying process can be spectacular. Lidded boxes that work year round with the desired fit can

be easily executed when grain is considered are a joy. Joints that are meant to be tight and sound are managed without failure if the maker understands and properly plans for the effects of grain. Whether you are a painter, sculptor, glass artist, or woodturner, not completely understanding your medium is a recipe for failure. It is definitely a good idea to take the time and effort to learn what can happen, good and bad, and use this knowledge to your advantage. ●

Ignoring the size difference, which grain orientation do you think will provide the stronger tenon for workholding? Thinking about grain should be a continual process for the woodturner



Understanding your material will make you a more accomplished woodturner. Take advantage of the characteristics and avoid the pitfalls. Whether single material, assemblies, or mixed materials, 'think grain'

