Multi-Axis Turning

A demonstration

by Brian Horais

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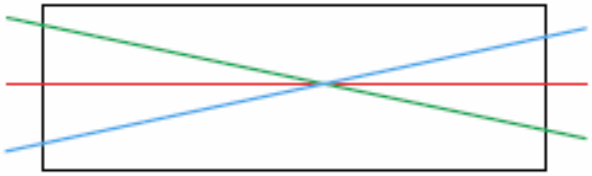
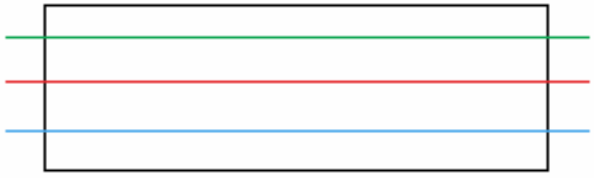
Multi-Axis Turning

- Turning on one central axis is straightforward and predictable.
  - When a spindle is turned on one central axis, the result (outcome) is always circular or cylindrical
- Changing the axis provides woodturners with unlimited forms, within the limits of the lathe and the wood (Barbara Dill, DEC 2011)
- When many axes are used, forms are randomly created by luck and experimentation
  - Multi-axis turning introduces many more variables that can be used to create a wide array of non-cylindrical shapes
- This demo will concentrate on one class of multi-axis turning: ***Three Axis Twisted Turnings***

The Basics



Twisted
(intersecting) Axis



Parallel
Axis

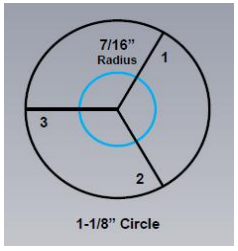
There are only two ways a new axis can be placed in relation to the center axis: parallel or intersecting.

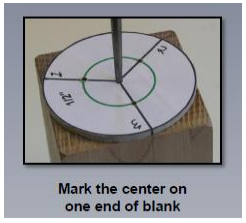
When a new axis intersects the center axis, the outcome looks twisted.
Keeping the numbering consistent is essential to help systematically create (or re-create) multi-axis designs

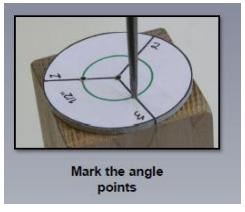
Complex Shape
from Twisted Axis

Making the Three Axis Turning

- Turn the spindle round first, with tenons on each end (for later holding)
- For three-axis, mark off 120 degree lines from center
- Determine the off-axis separation (~1/3 R to 1/2 R) and mark the off-axis points with a punch
- Number the axis on each end to be turned – be consistent and careful to maintain your numbering scheme
- Use a small sharp four prong drive center (5/8” is good)
- Use higher speeds (stop before vibration) and sharp tools
- Sand arc cuts by hand with the lathe off
- Make sample pieces and careful notes to define shapes



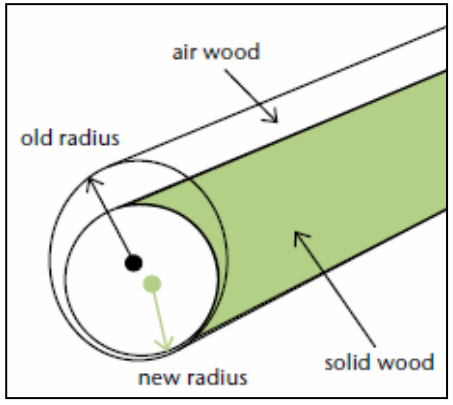




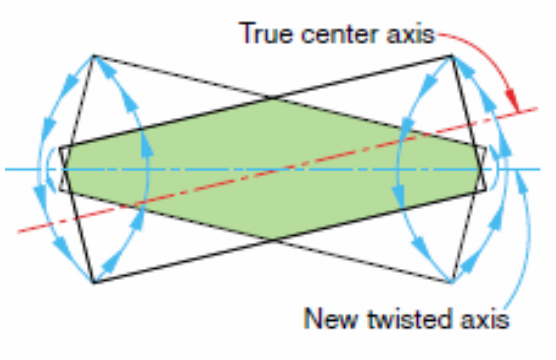
Draw a line to the other end of the blank and repeat the marking and numbering

Choosing the Offset Points

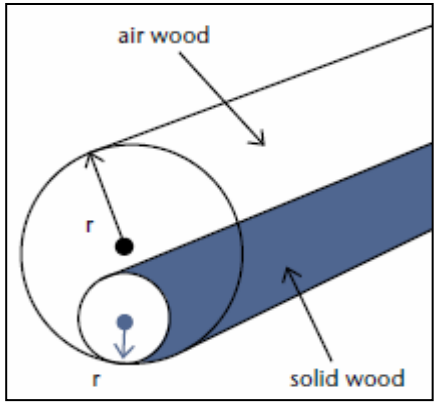
- Selection of the offset affects the final shape and the ‘wobble’ during turning (as well as the RPM for vibrations)



Small offset



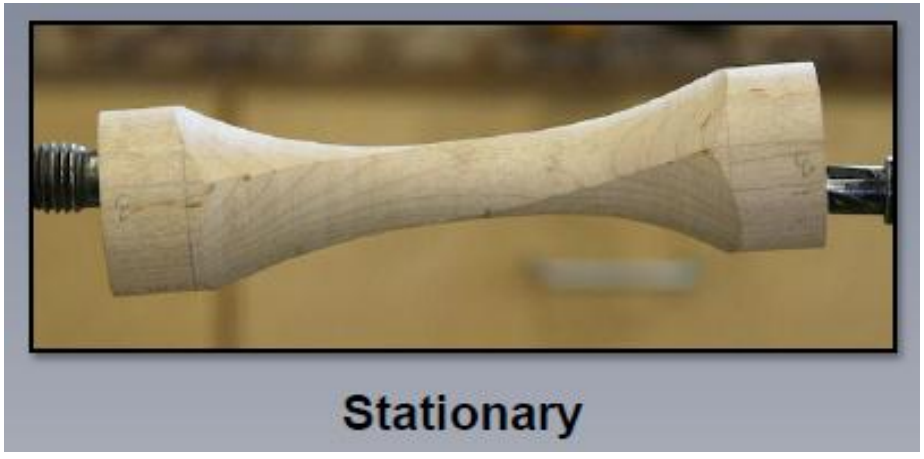
Offset ‘wobble’

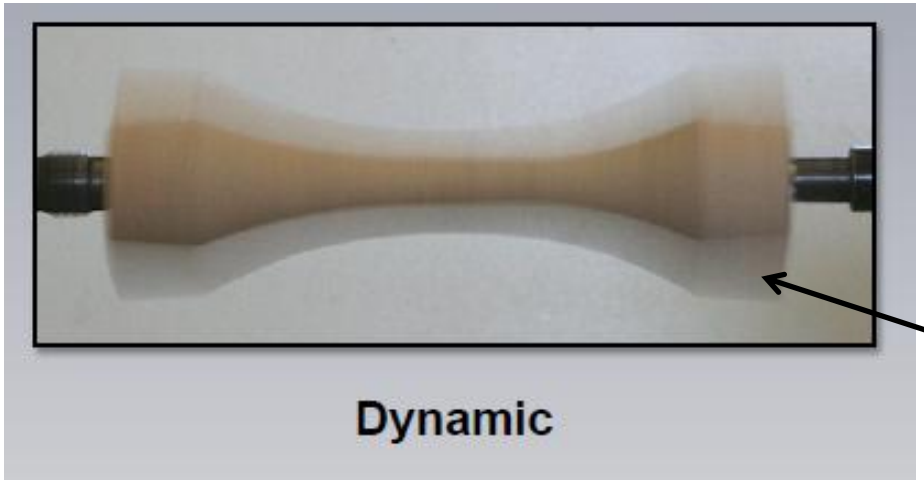


Large offset

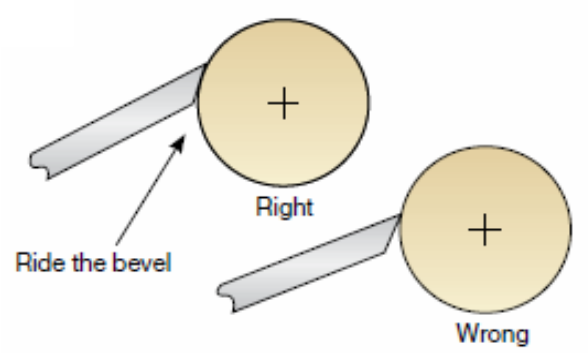
Drawings courtesy of Barbara Dill, 2011

A Simple Twisted Turning





'ride the bevel' of your tool when turning



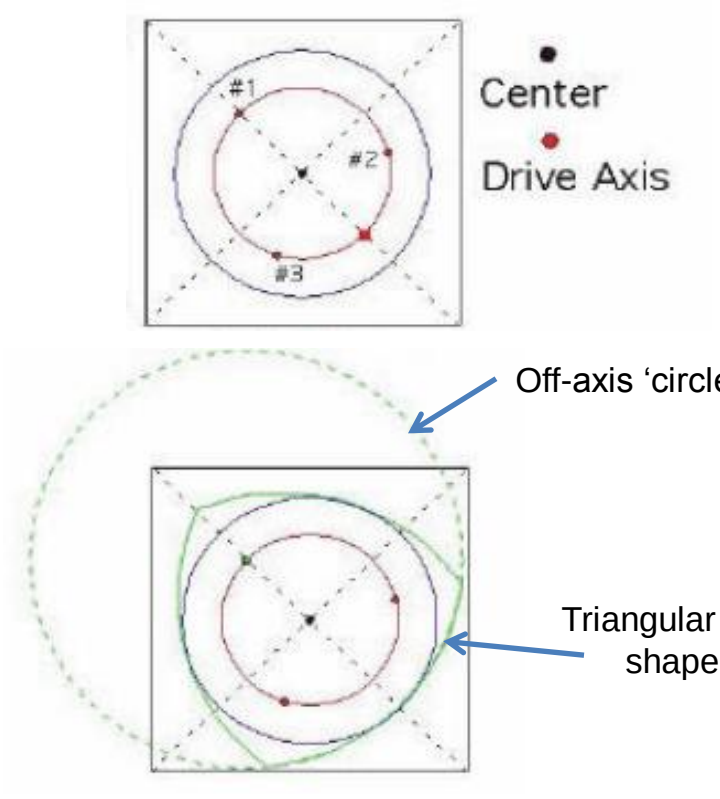
Turning sequence for the end points:

Head	Tail
1	2
2	3
3	1

This is the region where you are 'turning air'

3-axis offset yields triangular end shape

- Using a 3-axis offset scheme, with 120 degree separation yields a triangular end shape for the twisted section



A More Complex Twisted Turning

Twisted, slotted, segmented bowl by Brian Horais

Examples

Cautions and Tips

1. *The wood lathe is a reasonably safe tool, and it's fun to use ... but it will bite you if you're not careful.*
2. *Anything that can wrap up in the lathe will do so sooner or later.*
3. *Look everything over before you spin it. (turn it by hand first)*
4. *An off-balance piece can jump out of the chuck and pay a call on your nose. (adjust the speed to just below the vibrating range)*
5. *Irregular pieces are more dangerous, and deserve respect.*
6. *Be wary of the vibrations caused by off-axis turnings*
7. *The more your points are off the center axis, the more the object 'wobbles'*
8. *Be very cautious (i.e. approach slowly) when turning the wobbling ends (this is called 'turning air')*
9. *Sanding on a lathe can hurt you; don't take it lightly.*
10. *See that your chisels stay sharp.*
11. *Use the bevel of the tool to contact the wood (slowly)*
12. *Be extra careful when trying new techniques or ideas.*

References

- For a much more complete treatment of off-axis turning, visit Barbara Dill's website at:

www.barbaradill.com

- Review the tutorials and the Woodturners Magazine article from 2011