The Arrow's Flight

Understanding the arrow's relation to the bow.

Taught by The Honorable Lady Eve Stoneheart the Wagand, Forester of the Midrealm.

Choosing A Bow

Terms and concepts

There are many kinds of bow, both traditional and modern. While that is not the subject of this class, it can help to have a general knowledge of the types of bow, because it also has bearing on the arrows...You should not buy arrows until you have a bow, since the "draw weight" of a bow, combined with YOUR length of "draw" will determine what spine and length of arrow you will need.

*Longbow: The traditonal "Robin Hood" bow of England. Traditionally this is a long, straight or nearly straight length of wood, cut in such a way as to have a single "ring" of the original tree as the back (the side nearest the target). The maker "tillers" it until it will pull at the desired strength. While the "yew" bow was much celebrated as the English bow of choice, other woods were also used. According to the period text (Aschcam, Roger,"Toxophilus", 1545), a longbow should "come full compass" by which we infer he means a half circle when drawn. Modern engineering points out that increases bow shock and breakage, with all the stress being at the center. Modern bows are tillered differently in several ways, due to the aditional science available. In the US, Osage Orange and hickory are favored. Some woods, such as lemonwood, have a grainstructure that does not require the boyer to follow the grain. Bows of a single piece of wood are referred to as "self bows". They are great, but should be "exercised" gradually before a shoot. And remember...someday they will break. Someday. Fiberglass and various laminates are modern alternatives. More durable, and not affected by moisture. ****There is a "reflex, d-flex" version.*

Recurve: Before stringing it is almost a C, then when strung opposite to the C it becomes the "cupid's bow" shape we are familiar with. The originals were often composit bows of horn, wood and sinew, using tradional glues. Again, there are differences galore between fully traditional and modern. In the modern era they are made of fiberglass or laminated. In use, the recurve gives you "more bang for our buck". My 30# recurve shoots the same as my 37# longbow, with far less effort. The Mongolian horse bow is in this category, but more so.

Compound: Modern bows with wheels and cables, not SCA legal. There was an American tribe, the Penobscot, who had a "curious double bow" that delivers a compound drive, but it, too, is not sca legal.

There are many other factors that affect how the bow works for the archer, especially with bows using wheels and pulleys. Some of the terms you will hear are: "stacking" and "shock" and "let off".

Now the arrows….

Bow weight and arrow spine: Why does the fletcher say to buy the bow first?

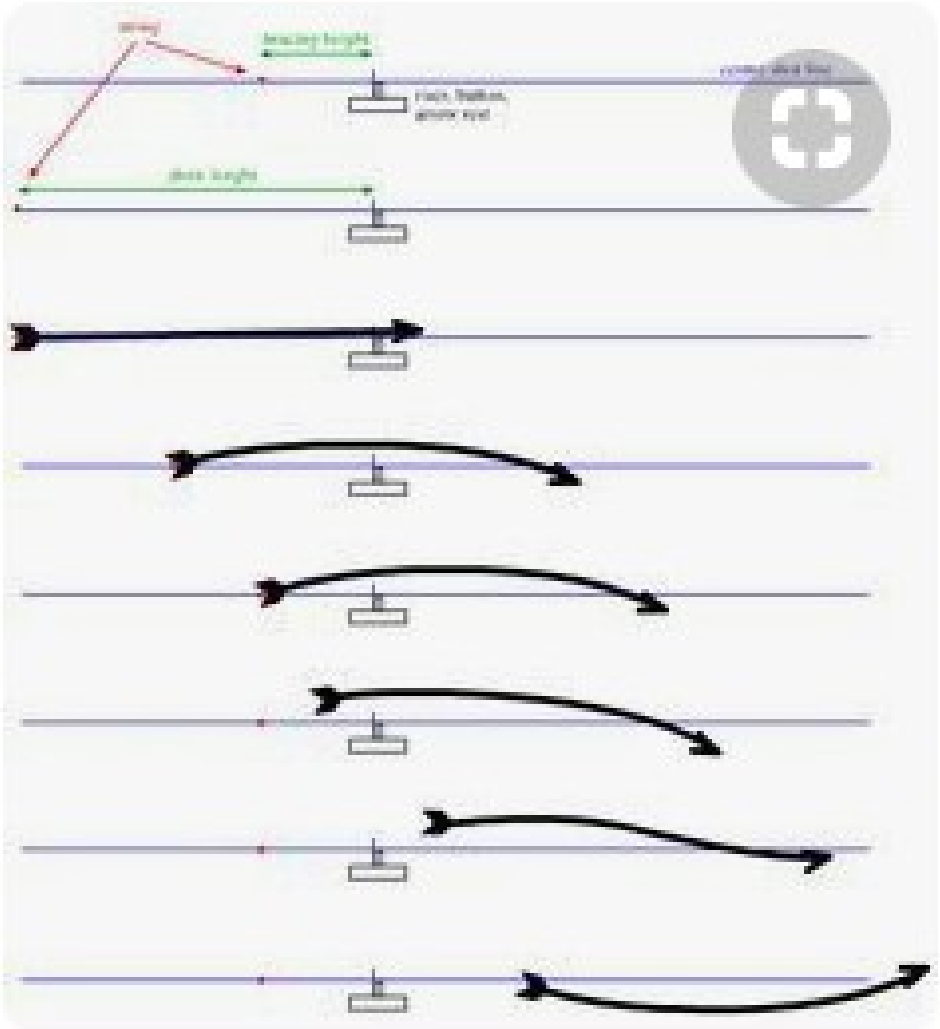
Definitions:

Draw weight: How much strength it takes to draw a bow to a specific distance. The weight is often written right on the bow, and if it just says 30# it probably means 30# draw at 28". Some are measured at other distances, but usually say so. A rough guide: every inch plus or minus the given "draw weight" will change the poundage by 5#. So, if you draw your 50# bow only 26", you are at about a 40# spine...go to 45 for safety. Your fletcher will do these calculations, and explain them.

"Spine" weight: A measurement of the bendability of an individual shaft. The commerical market does this as a mass production job, and there will be a few that slip by with slightly higher or lower spine values. Some fletchers will take the time to re-test by hand, which can give better results. The wrong "spine" will cause problems in how it flies, and how you aim.

Shaft weight: How much did the wood for your arrow weigh before it was made? Different weight arrows will fly at different speeds. They all drop at the same speed, but if they get there later it will land lower. "Fear the one arrow archer" because he knows exactly where it will go. If you can afford it, get your arrows with matched arrow weight. That is usually possible, but you will seldom be able to get your new set to match the old. 5 "grains" is the weight of a postage stamp, so try for a 5 or 10 grain range.

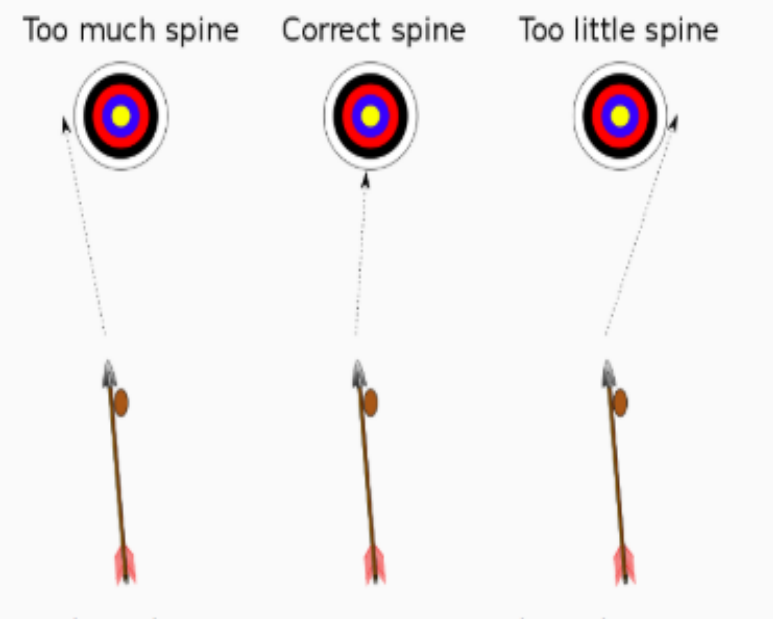
When you release the string the arrow is pushed forward by the power of the bow. This causes the arrow to flex. If you have the right spine of arrow you will probably not be able to see this, as it will self-correct very quickly.



It is pretty easy to see when you have much too high of a spine for your bow, with the arrow seeming to zig-zagging down to the target. You will also see a result in how you need to aim If you are consistantly going to the right or left of the target it may be the result of how your arrows are spined. Too low a spine and your arrows can break in your face.

To see it in action: http://www.real-world-physics-problems.com/physics-of-archery.html

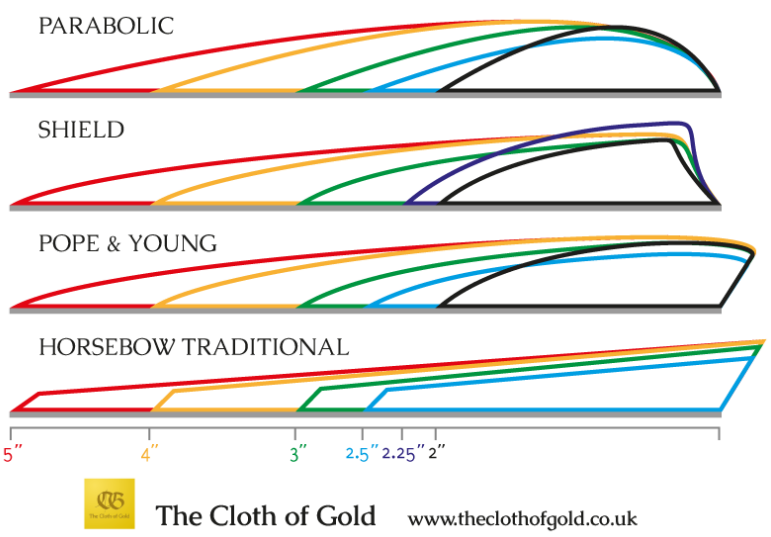
(A poor release can also cause these results. Don't release and wave!)



Fletches:

The fletching (feathers) serve to stabilize the flight of your arrow, but they also add both weight and drag. The balance point of your arrow should be just to the front of the center of your shaft. Most arrows are OK as far as that goes. The next factor is drag. More fletch, more drag, less fletch, less stabilization. Because they are showy you often find arrows of almost any weight being sold with 4" shield-cut fletches. The extra drag slows your arrow, so you will need to aim a little higher. Heilical fletches have too much drag unless you shoot a very high poundage bow. It is normal for fletches to have a slight "offset" to aid in stabilization, so don't let that throw you.

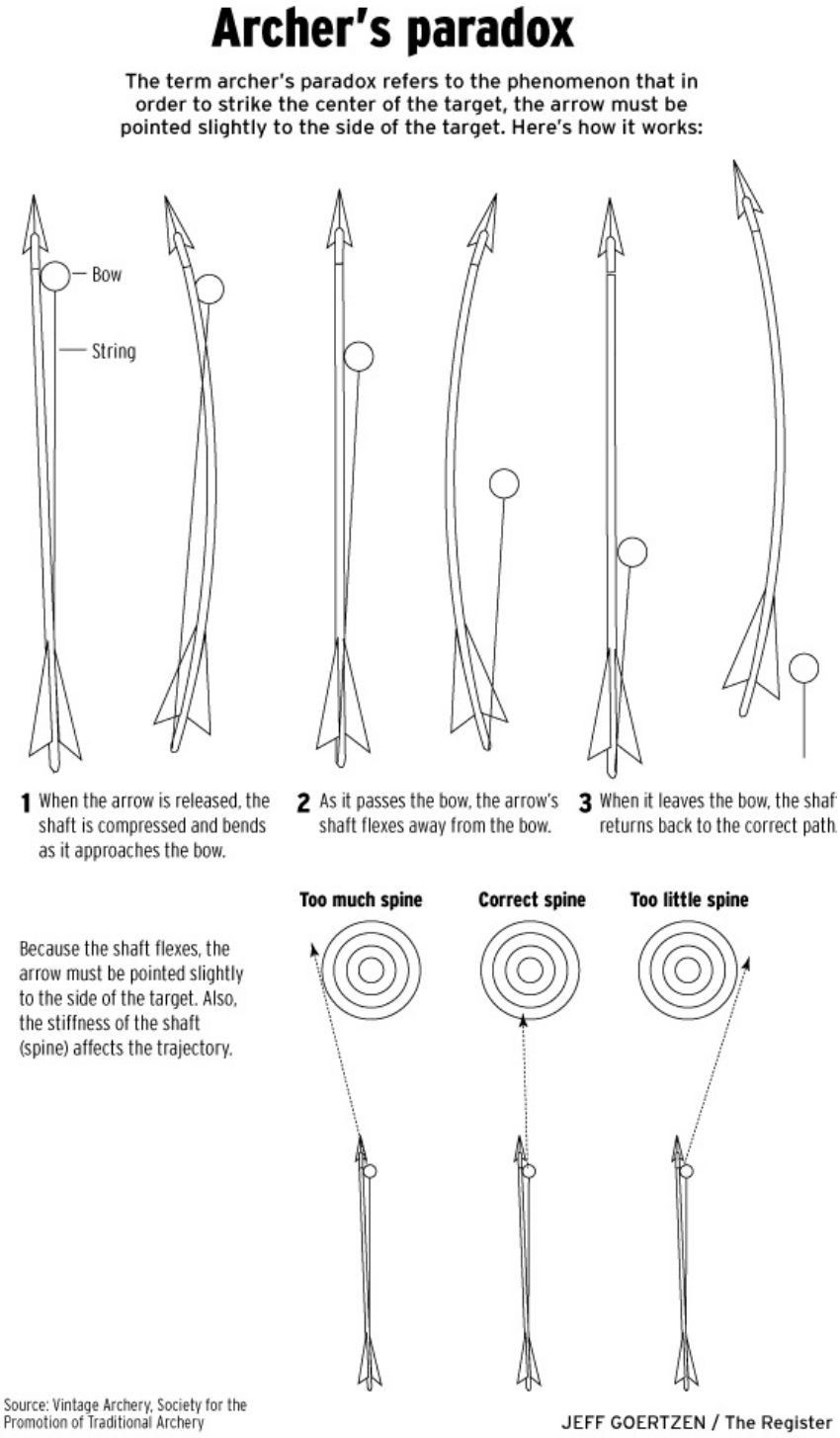
Years ago I was told that the parabolic has the least drag, but I don't really know. Get what is available, or what you like. Other options: Diced feathers (yes, proveably period, but time consuming). The weight of your point will be a factor as well, since the force of the string will have to push more if your point is heavy, and your arrow may not balance. It needs to be heavy enough for stability, and to have enough mass to push into the target. 100 grain is standard, although some archers with heavier bows and arrows will choose 125. (OK, too much information….have the fletcher set it up.)



On Aiming, or **Why didn't it go where I pointed it?** When your arrow leaves the rest it goes up a little, then falls at the rate of anything else as it moves forward, 32 ft per second, per second. The faster it moves, the further it goes before it hits the dirt. That is part of why you cannot just sight down the arrow...they just don't go that fast. Another reason is your face and eye is usually somewhat above your arrow's nock, and shouldn't be behind it anyway. The third reason is something called "The Archer's Paradox".

The Archer's Paradox:
On most bows the arrow is at an angle from the line made by the arrow and the bow. It is actually pointed quite a bit to the side. When you draw the arrow it is a lesser angle, but still an angle. Your release also alters the travel of the string, causing it to go back and forth as well as forward. Even with a perfect release there is a little side to side action. The arrow flexes, with more flex with greater angles. Modern center or near-center shot bows have less of this than old style long bows, but it still occurs

To see it in action, see:
http://www.real-world-physics-problems.com/physics-of-archery.html



Is your **string** the right length for the bow? There are two points to check: Length and thickness.

The **length of your string** depends on the bow. Once in place you have a "brace height"--the length between the grip and the string. The old rule was one "fistmele" brace height between the back of the bow and the string at rest. That is a place to start. On my Martin 100 I tried that when I replaced the string, and spent a season tweaking my nose with every shot. I finally called the manufacturer and found it was supposed to be several inches higher. I made note of the length of the correct string once I had one. If you have a "flemish twist" string the length can vary if the number of twists changes. Don't be afraid to give it a few more twists if it needs it.

The **thickness of the string** should be right for your bow. Remember, your bow is already pushing an arrow, so having it push an overly thick string is wasted effort. Period strings were linen or sinew, and thats well and good, but for safety and reliability modern dacron is the way to go. My 30# Martin 100 string had 9 (?) strands. The spool of Dacon used by your stringmaker will have a chart telling you how many strands per pound—follow the directions, or have the maker do so. Too many strands will be safe, too few bad for you and your bow. Remember—Draw poundage not just bow poundage! And bear in mind that guy you hand it to might draw it farther than you do. Always leave a safety margin.

And, finally, there is you. "Every action has an equal and opposite reaction." Your release has a great affect on the arrow's flight, as well as how you hold your bow.

Points to remember:

The bow is a bird, not a hammer—hold it just enough not to drop it. You should be able to open your bow hand when your bow is at draw.

Hold the string just enough, and ***when you release just open your hand and move your hand back to touch your ear.*** You "funnel" the reaction there instead of it spoiling your aim. Do not let it fly around, waving at the crowd.

Think of the arrow traveling between two ***"panes of glass".***

Don't "drop" your bow. Close your hand if you opened it, but keep it at the same level before you as you watch your arrow hit the target.

Be sure your **nock point** (if you use one) is set correctly. This will be about 1/4" above a straight line at right angles from the bow. Watch your arrow as it flies—or better, have someone else watch from the the side (but still on the safe side of the shooting line.) Does it "jump like a porpoise" or does it dive for the dirt? Small adjustments can mean a lot.

Stacking: This is how the bow responds to the pull of your arm. Some bows "stack" worse than others—it is harder to pull them for a longer time as you pull back, having to do with the construction of the bow. Try a bow before you buy it if possible, even if it is just pulling back an empty string. **Never dry fire a bow.** Dry firing is releasing the string without anything for it to push. All of the force then is on the limb of the bow, encouraging breakage.

"Let Off": This is a term applying to modern wheel and pulley bows. They may take 80 pounds to pull back, but only 10 lbs. to hold while aiming. Again, not on SCA legal bows.