Introduction

What is a dart?

The dart is an ancient weapon, first used over 20,000 years ago and still in use today.

It is essentially a light spear (or large arrow) and is thrown with an ***atlatl***, a tool that acts like a lever and gives the dart maximum thrust and power.

How much thrust? They've been clocked at over 100 miles per hour. How much power? Enough to bring down a mammoth. Dart points have been found embedded in their bones.

There are places that sell ready-made darts, and there are several books and websites that tell you how to make one. These are good darts, and they throw well. But none of them explain **how** a dart works -- why you need that size shaft, that kind of tip, that style of fletching.

That's the reason for this book. I don't want to tell you how to put one particular dart together, I want to try to explain how the parts of a dart work together so you can make your own in a variety of styles.

I'm not an expert dart-maker by any means. I've made quite a few and have tried a lot of different methods and materials, so I feel comfortable with the process. But I realize there's a lot I still have to learn -- and the best way to learn is through experience. With that in mind, this book should **not** be taken as the final word on the subject. It's merely a place to start.

There's a lot of information on the next few pages, and it can be confusing if you just read through and try to remember everything. So don't do it that way. This book is designed to be a reference, something you have on hand when you're looking for a shaft, or trying to decide on what fletching to use, or trying to decide on a point.

With this information, you should be able to go out in the woods and find a piece of wood and determine if it's suitable for a shaft, then make it more suitable, and then turn it into a finished dart. You don't need to follow every step for every dart you make, but it won't hurt anything if you do. Eventually you'll get to the point where you understand it well enough to skip a step here and there, and finally you'll know it well enough to just throw this book away.

When you reach that point, congratulations!

- Daryl

Glossary

In this book, I'll be using several terms which may not be familiar to everybody. They will also be explained in more detail in the appropriate section.

Materials:

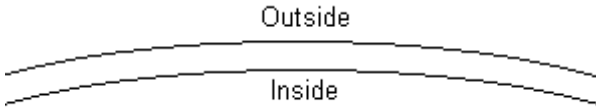
- **Cane** - any rigid, woody member of the grass family. This includes bamboo, rivercane, rattan, etc.
- **Natural Wood** - any non-processed piece of wood, such as saplings, shoots, branches, etc.
- **Milled Wood** - any processed wooden material, such as dowels or lumber.

Parts of the Dart

- **Shaft** - the body of the dart, commonly made out of wood or cane.
- **Mainshaft** - a shaft which has been specially prepared to accept a smaller secondary shaft in the front.
- **Foreshaft** - a smaller secondary shaft, inserted into the mainshaft.
- **Tip** - the front end of the shaft, where the point or foreshaft is located.
- **End** - the rear end of the shaft, where the nock is located.
- **Nock** - the dimple on the end of the shaft where the atlatl peg engages the dart.
- **Fletching** - the feathers or vanes on the rear of the shaft, used to keep the dart stable in flight.
- **Point** - any type of point (projectile point, antler tip, modern arrow point, etc.) on the tip of the shaft.
- **Collar** - an "adapter" used to make the nock end larger in diameter.

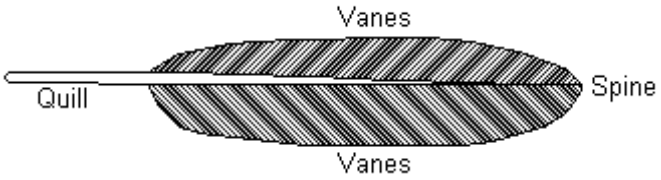
Parts of a Bent Shaft:

- **Inside** - the shorter, inner part of the bend.
- **Outside** - the longer, outer part.



Parts of the Feather

- **Spine** - the hard part of the feather, running up the middle.
- **Quill** - the exposed end of the spine, which used to be attached to the bird.
- **Vanes** - the "feathery" part of the feather.



Terms

- **Balance Point** - the position on the shaft where it is evenly balanced.
- **Spine** - The stiffness or flexibility of the shaft.
- **Forward of Center (FOC)** - the percentage that the balance point is ahead of the center.

The Raw Shaft

The shaft is the foundation for the whole dart -- with a good shaft, it'll fly well even if you have problems with the fletching and point. With a bad shaft, nothing you do is going to make it work.

These are the characteristics to look for in a raw shaft, but only the spine is really critical -- everything else is variable or can be corrected.

Materials:

Any piece of wood or cane that is strong, flexible, and long enough will work. Some types are better suited to handle the stresses a dart encounters, though. Woods with a longer grain, such as fir, cedar, maple, or spruce, are more resilient. They will flex better and last longer, because they're not as prone to breakage. Cane also has very long grains, and has the added advantage of being hollow so they don't need to be drilled if you decide to use a foreshaft. Just make sure the piece isn't too brittle -- if you can easily snap it in your hands, it obviously won't work.

Some people like to be more authentic (or more primitive, or just more opportunistic) and use only materials that grow in their area. If you live next to a stand of willow trees, why go out and buy something else? Even if you're not using the best possible material, keep in mind that ancient hunters used whatever was on hand and **still** managed to bring down mammoths.

Straightness:

While it **is** important for the final dart to be straight, the raw shaft doesn't have to be. As long as no single bend is more than about 10 degrees, it should be possible to straighten it.

Length:

There is no "perfect" length for a dart. I know people who use 3' darts and others who use 8' darts. In Australia, they use darts up to 12' long! It really depends on what you're comfortable with, but there are a couple of general guidelines.

First, you should consider the length of your atlatl. In my experience, the dart should be between 3 and 4 times the atlatl length -- if you have an 18" atlatl, darts between 54" and 72" will work best in terms of balance and leverage.

Second, it seems to help if you use a dart that's about your height. I'm more comfortable with 6' darts, while my wife prefers 5' darts. Children usually do better with 3' or 4' shafts. But this is just a guideline -- I can throw 5' or 7' darts without any problem. I just prefer the feel of a 6' one.

You should also decide whether you'll be using a foreshaft or not. If you want to end up with a 6' dart and you'll be using a 12" foreshaft, then the main shaft should be about 5' long. Also, if you find a shaft that fits all the other criteria but is too short (3' to 4'), a foreshaft can bring it to a good throwing length.

Diameter:

There is no "perfect" diameter, either. I've seen wooden darts from 5/16" in diameter (about the size of an arrow) up to 5/8" in diameter. 1/2" is more common, though, and is easier to handle (and throw). If you're using a tapered material for the shaft (sapling, bamboo, or rivercane), try to use a piece that is no larger than 3/4" on the large end and no less than 3/8" on the small end. If the large end is too large, it will create extra resistance and will slow the dart down. If the small end is too small, the atlatl peg won't be able to engage it well enough to throw. You **may** be able to use a collar to overcome this, however.

Taper:

Whether you use tapered or straight shafts is up to you. Round dowels will work fine, but it will take more effort to make them fly well. If you use a tapered shaft, be sure to use the larger end as the tip. This will help the flight stability and will work better if you decide to use a foreshaft.

Weight:

A dart (with tip, fletching, and foreshaft) usually weighs between 3 and 8 ounces. Subtracting an ounce for the extras leaves you with a shaft of between 2 and 7 ounces. If the dart is any lighter, it doesn't have enough mass to throw well; any heavier and it's difficult to get enough speed or thrust. You can throw a baseball farther than either a BB or a shot put. You don't really need to weigh it, though -- the length and diameter determine how heavy it will be. 4 ounces is about average, but use whatever feels comfortable. Larger people usually throw heavier darts better; smaller people are better with lighter darts.

Spine

Spine is the measure of how flexible the shaft of the dart is, which determines how well the dart will fly. It is determined by measuring how many pounds of force are needed to make the shaft flex. A lower rating means it is more flexible; a higher rating means it is stiffer. When the spine is matched to the propulsion force, it flies better. An arrow with a 50 lb. spine is designed to be used with a bow with a 50 lb. draw. A dart should have a 5 to 10 lb. spine, because that's how hard a person throws.

The best way to determine the spine of a dart is to get out the bathroom scale. Put one end of the dart on the scale and stand it upright. Put a finger on the top and press down. When the shaft begins to flex, look at the scale. That's it.

Or just trust your own judgment. Put the dart on the ground instead of the scale and push down. If it flexes with very little pressure, it's probably too limber (too little spine). If it takes a lot of force, it's probably too stiff (too much spine). If it isn't too far off, it may be possible to correct it.

If you throw with a lot of force, you use should use stiffer darts; if you throw more casually, use more flexible ones. But be careful -- too little spine will cause the dart to nose-dive when you throw it, with the point dropping down almost immediately. A dart with too much spine will put the point up and fly almost vertically. The reason for this can be explained through physics, but to be honest I don't really understand it myself. It works. That's what matters.

Balance Point

The balance point of the dart is important because it determines how smoothly the dart flies, and also how much fletching you are going to need. Measure the length of the shaft and find the physical center. Then, using something with a sharp edge, find the balance point. As long as it is at or ahead (towards the tip) of the physical center, the shaft should work. For now, that's all you need to determine -- fine-tuning the balance point for optimal flight is covered later (under FOC).

Summary:

Putting all this information together, we can come up with the following guidelines:

Material:	anything suitable	**Taper:**	Doesn't matter
Straightness:	No serious bends	**Weight:**	2 - 7 oz..
Length:	48" - 96"	**Spine:**	5 - 10 lbs.
Diameter:	3/8" - 5/8"	**Balance:**	Ahead of center

If you can find a piece of shaft material that fits those parameters, you are ready to start.

Correcting the Shaft

You now have a raw shaft that's got all the right dimensions, but the spine's a little off and it's not very straight. This section will help you turn it into a finished shaft. You should do these steps in the order listed - it will go a lot smoother.

Stripping:

If you're working on a branch or a sapling, strip all of the bark off. Until you know what the wood looks like underneath, you won't know what needs to be fixed. If you have an easy piece, you can just pull the bark off. If you have a tougher piece, you'll probably need a knife to shave the bark off.

Smoothing:

Now take your knife and shave off any high points, branch stubs, nodes, etc. The smoother you can make the surface of your shaft, the easier it will be to work with.

Correcting the Spine:

If the dart has too much spine, you can try to correct it by reducing the diameter of the shaft, either along the entire length or by tapering it smoothly towards the nock end. You can do this by sanding, shaving, or planing. In addition, you **may** be able to correct too much spine by adding a fairly long foreshaft, depending on how far off it is. This changes the balance point and FOC, however, and doesn't always work.

If the dart has too little spine, you can correct it by cutting off the narrow end of the shaft. Do this an inch at a time -- take some off, then re-test the spine. If you're using a tapered shaft, almost all of the flex will be in the bottom 1/3 (by the fletching) anyway, so it usually doesn't take too much trimming to adjust it.

If you can't get the spine close enough to the 5 to 10 lb. range, it's better to throw the shaft out and start over. It's a hard decision to make, but it will save you a lot of time and effort working on a bad dart.

Straightening:

This can be the hardest part of the shaft preparation, depending on how far off the shaft is. To check the straightness, simply hold one end of the shaft up to your eye and hold the other end out, then rotate it. You'll be able to find the trouble spots very quickly.

Hand Straightening:

The simplest way to straighten a wooden shaft (sapling or branch) is by hand. It is easy to do and can be performed anywhere., as long as the wood is still flexible.

Look down the shaft and find a bend. Holding the shaft in both hands, one hand on either side of the bend, place your thumbs on the outside (high side) of the bend. Gently pull it towards you while pushing with your thumbs until it's a little past straight, then release.

Another way to do it is by using the heel of your hand to push against the bend while you are sighting down the shaft. Either of these methods will probably take several repetitions, and probably won't last for very long with hard woods. Softer woods may or may not stay straight for very long, but you can easily reshape it as needed.

If you hear the fibers crackling as you are doing this, stop immediately. You're tearing the wood fibers apart, which will weaken the dart. The shaft isn't ruined, but you'll need to use a different method to straighten it any further.

Hook Straightening:

This is a method of straightening which has probably been around as long as the atlatl has. In the United States, they have found shaft "wrenches" made out of mammoth bones! Today, a more common tool is a large screw hook set into a handle of some sort.

The shaft hook (or wrench) is a tool with either an open or closed loop which is larger in diameter than the shaft. "Hooking" works by compressing the fibers of the wood on the outside of the bend, forcing it to straighten out. It is longer-lasting than hand-straightening, but still may not be permanent.

Sight down the shaft to locate a bend. Using your hook, rub the shaft along the outside of the bend. Use moderate pressure at first and long strokes. Be sure to keep checking for straightness. As you get closer to the desired degree of straightness, you can decrease the pressure and the length of the strokes.

Heat Straightening:

For bamboo or rivercane (or stubborn wood), you need to work a lot harder. About the only way to straighten these is through heat.

If your shaft material is dry, you need to soak it for 12 to 24 hours to rehydrate it. If you try to heat and bend rivercane or bamboo that is too dry, it will scorch or break. You can put it in anything that is long enough to hold it -- a nearby creek, a swimming pool, a piece of PVC pipe that's sealed on one end and stood upright. Don't worry about the moisture -- after you're done, the excess will simply evaporate out.

The heat source can be anything, as long as it is **dry** heat. Some people prefer propane torches, others use their stove burners on high. Use whatever you have access to.

Note: Don't just work your way up the shaft, straightening as you go. If you work on a bend that is too close to one you just finished, you will most likely warp the first one again. Try to stay at least 12" away. After 5 minutes or so, when the correction has had some time to set, you can go back.

Heat the **inside** of the bend or kink until you see "sweat" (condensation) appearing on the other side of the shaft. The cane should take on a rubbery consistency. Using a leather pad on your knee and/or thick leather gloves, over-bend it (past straight), then re-straighten it. This prevents the cane from warping back to its original shape.

If there is a huge kink that you are unable to straighten completely, you can correct **around** it. Your dart doesn't have to be perfectly straight, as long as the nock and the tip are aligned. Go up or down a little way from the kink and bend the shaft back into line around it.

Using these methods, you should be able to end up with a nice, straight shaft. But there are some pieces of wood, bamboo, or rivercane that just can't be fixed. If that's the case, and you can't simply cut it shorter to remove the kink, you'll have to throw it out and start over.

Sanding:

If you'd like, you can smooth the finished shaft by sanding it or by using an abrasive stone of some kind. This isn't vital, but it does make the dart look (and feel) nicer. This isn't recommended for bamboo or rivercane - the outer surface acts as a waterproofing agent and holds the fibers in place.

Handy Skills

There are two things you're going to be doing a lot as you finish up the dart -- wrapping and gluing.

Wrapping:

You will need to wrap several parts of the dart. There's the nock, the point, the end of the mainshaft if you're using a foreshaft, and the fletching. In addition, you can wrap the shaft to add weight to the front end if you need to.

Wrapping simply consists of using some sort of cordage and wrapping it around the shaft. You can use almost anything that's strong enough -- upholstery thread, kite string, artificial sinew (waxed polyester fibers), leather thongs, real sinew, or thin, wet rawhide strips. If you're in a hurry, or if it's something you may need to change later, you can even use filament (strapping) tape! I usually do this when I'm experimenting with fletching styles or if I just need to make quick demo darts.

You can use whatever you have on hand, but leather, real sinew, and rawhide can be hard to come by in long enough lengths and can be quite expensive. If you're just making up one dart, that's not usually a problem, but if you'll be making several, you may want to use something else.

Whatever you decide to use, make sure your wrapping is tight -- make sure the strands are touching each other as you work your way around.

If I'm using string or artificial sinew, I usually just make a simple slip knot to hold it tight around the shaft as I begin, then wrap my way back over it. If you use leather, real sinew, or rawhide, you can usually just lay one end on the shaft and wrap over it. In addition, I usually use a drop of glue on the end to keep it from unwrapping.

If you want, you can also glue the wrapping where it is exposed on an end, like the nock or the mainshaft. This will keep it from fraying.

Gluing:

The points may need gluing (depending on what style you use), and the fletching may need gluing as well. There are several types you can use -- white glue, hot glue, hide glue, epoxy, or some kind of natural pitch or tar.

- White glue is almost always on hand, but isn't very effective except for tacking down threads or string.
- Hot glue is the quickest and easiest, but doesn't really hold very well, and it looks tacky (so to speak).
- Hide glue is the most authentic, but can be hard to come by. If you want to, though, you can make your own from Knox gelatin from the store! Simply mix in enough water to make a paste, then microwave it for 30 to 45 seconds. Hide glue takes quite a while to dry, though.
- Epoxy isn't authentic, but it is permanent. 5 minute epoxy will set quickly and last forever. If you never want to think about it again, this is probably the way to go.
- Pitch is just the hard sap from any of a number of trees. Pine, cherry, and others will sometimes have hard nodules of dried sap on the bark. Just collect it, heat it, and apply it. Pitch isn't a very effective adhesive, however. But it will work.

Again, it's a matter of what you prefer to use. If I'm doing quick darts or touch-ups, I usually use hot glue just for the convenience. But if I want to make a authentic primitive dart, I use hide glue or pitch. I usually stay away from epoxy because I have children around, so safety is also a factor.

Finishing the Dart

Now that you have a suitable shaft, all you need to do is everything else. You need to figure out the F.O.C., add a point or foreshaft, fletch it, and make a nock. Fortunately, all this **sounds** like a lot more work than it actually is.

Again, these should be done in the order listed. You don't have to, but it will be easier if you do. If you try to do the fletching before you work on the point, you may end up injuring the feathers as you're moving the shaft around.

Forward of Center

Forward of Center (FOC) is an archery term I've almost never heard applied to darts, but it is a VERY important thing to understand.

Simply stated, the balance point of the dart has to be ahead of the center of the dart, which means the tip end has to be heavier than the fletched end. Otherwise, you won't be able to get a dart that flies well or very far. That's why when you build a dart, the big end of the taper goes in front - not because it's aerodynamic, but because it's **heavier**.

FOC is where the balance point of the dart is located, expressed as a percentage of the whole length. It is calculated this way:

1. Measure the total length of the dart and divide it in half. This is the physical center.
2. Using something with a sharp edge, find the balance point of the dart.
3. Measure from the balance point back to the center.
4. Divide the distance from the balance point to the center by the total length of the dart, then multiply by 100. This is the FOC percentage.

Example: Let's use a 72" dart. The center would be at 36". If the balance point is 3" ahead of the center, we would take 3" divided by 72" * 100, for an FOC of 4.2%.

So now that you know the figure, **what does it mean**? It means this is how well your dart will fly. In archery, they recommend an FOC of 7 - 9% for target arrows and 10 - 16% for hunting arrows. This is true for darts as well. Generally speaking, a lower FOC means it will fly straighter, while a higher FOC means it will travel faster (this is partly due to the amount of fletching needed). The dart used in our example isn't bad, but by adding weight to the tip (heavier point, foreshaft, add weight, etc.), we can move the FOC forward, which means we'll have a dart that flies better.

QUICK FOC CHART

Dart Length	BP Ahead of Center				
	2"	**4"**	**6"**	**8"**	**10"**
54"	3.7%	7.4%	11.1%	14.8%	18.5%
60"	3.3	6.7	10.0	13.3	16.7
66"	3.0	6.1	9.1	12.1	15.1
72"	2.8	5.6	8.3	11.1	13.9
78"	2.6	5.1	7.7	10.3	12.8
84"	2.4	4.8	7.1	9.5	11.9

If you are making a 60" dart, you would want the balance point to be 4" to 10" ahead of the center. It doesn't **have** to be, but the dart will fly better if it is.

If the FOC is zero, exactly at the center, you can **still** make the dart fly fairly well with a lot of fletching. But the farther forward the FOC is, the less fletching you need, because the dart is more stable in flight. If the FOC is around 20%, you don't need any fletching at all (that's the secret to using unfletched darts or arrows).

Note: This has nothing to do with the total weight of the dart. Whether you use a 2 oz. dart or a 8 oz. one, if you're using a 72" dart and the balance point is 4" ahead of center, it is STILL an FOC of 5.6%.

The reason you calculate this **before** you add points or fletching is because this may affect what you choose to do. In the shaft we used as an example, an FOC of 4.2% is a little low, so I may want to use a heavier point of some sort to move it forward. If the FOC had come out to about 8%, I might have just sharpened it and let it go at that.

Foreshafts:

A foreshaft is a smaller, secondary shaft you insert into the tip of the mainshaft, up to 24" long (but usually about 8"). If you're using a wooden shaft it's more difficult to do, but there are many benefits to adding a foreshaft.

- It adds to the overall length of the dart, which will change the balance point and FOC.
- It makes your dart a multi-purpose tool -- if you permanently attach a point to your shaft, you have a dart that's good for hunting one thing. If you use a foreshaft, you can make up a variety of different ones (blunts, bird tips, large game points) and just "load" whichever one is appropriate to the situation. This was done with some ancients darts and arrows. This meant you only needed to carry a few main shafts with you and a kit full of various "loads" for it, which was an advantage to a hunter on foot.
- It added to the hunting effectiveness. If you hit an animal with a one-piece dart and it ran off, you lost your dart and it would most likely be broken even if you did catch the animal. With a foreshaft, if you hit an animal and it ran off, the foreshaft would come loose and stay in the animal while the main shaft fell off in front of you. All you needed to do was "re-load" it with a new tip and you were ready again.
- After a while, the projectile points can break or split the shaft. If the point is permanently attached, you end up losing a few inches of length if you're lucky, and an entire shaft if you're not. By using a foreshaft, you're only out a small shaft which can be quickly replaced. 12" pieces of wood are a lot easier to find than 72" pieces.
- In my experience, a 5' dart is easier to throw at smaller targets closer to the ground, while a 6' dart works better at large targets a few feet above. You can make foreshafts in different lengths to customize the dart for the target.

Readying the main shaft for a foreshaft is very easy if you're using cane (bamboo or rivercane), and more difficult if you're using wood. Since cane is already hollow, you don't need to drill it. With wood, you do.

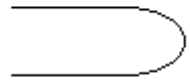
The first step is to wrap the end of the mainshaft for at **least** 2", preferably more. The shaft will be thinned out quite a bit, and the fibers will try to separate with every impact. Wrapping it prevents breakage and helps the main shaft grip the foreshaft.

Now you need to drill the end of the wooden shafts. I wish there was an easy way to do it, but there isn't. Get out your electric drill with a bit about 3/16" smaller than the diameter of the shaft (if you have a 1/2" shaft, use a 5/16" bit). As carefully as you can, drill straight into the shaft to a depth of about 2".

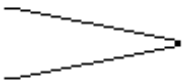
If your cane isn't completely hollow or isn't perfectly round, you can touch it up with a drill bit as well, but it's much easier to do since the center is softer. The bit will go in straight.

Quick Points:

If you just want to make a quick point and don't need to adjust the FOC, there are two things you can do.



Blunt Tip -- simply round off the end of the shaft (or foreshaft). This won't penetrate anything, but is safe for general practice tossing in areas with people around and will work for bringing down small game by stunning them.

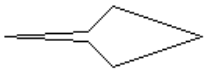


Sharpened -- just get out your knife and whittle the tip down to a point. This is very easy to do and will give you a good "target" dart. For cane, you will need to sharpen it off-center (since the center is hollow), but this won't affect the performance.

Affixed Points:

If you decide to add a separate point to the shaft or foreshaft, either for looks, weight, or authenticity, there are three basic styles to choose from. These are **inserted**, **drilled**, and **flat**. The style you choose will determine what you need to do to the shaft, and you may end up choosing a particular style depending on how much weight you need to add to the tip.

Inserted Points:

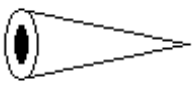


These are points that slide into a hole drilled in the end of the shaft and are usually made out of wood or metal. The simplest form is just a small sharpened piece of wood, like a miniature foreshaft. Copper points in this style have been found as well.

You can also make your dart into a "weighted blunt" by inserting a screw or bolt into the shaft. I usually use a #10 x 1" sheet metal screw for bamboo, up to a 3/8" x 1 1/2" bolt for rivercane.

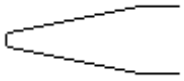
To prepare your shaft, wrap the end down about 2" (or farther if you have a longer insert). Make sure the wrapping goes at **least** 1/2" below the bottom of the insert to prevent the shaft from splitting. Drill a hole just slightly smaller than the diameter of the insert, going in about 1/2" longer than the insert. If this is going to be a permanent tip, put some glue in the hole, then slide the point in. Stand the dart on the tip on a hard surface, then push down **hard** to make sure it's seated properly.

Drilled Points:



These are points that have been drilled or hollowed out so they slide over the end of the shaft. Antler tips are a common form, and modern archery points fall into this group. You can also make cones out of heavy wood. These points don't work on cane.

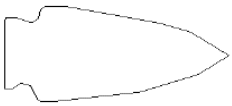
To prepare your shaft for these, you need to shave the end down to a taper, making sure the point will fit on snugly. You can use a knife, or you could use a shaft taper tool for arrows. These are usually too small for a dart shaft, though. When it's ready, just put some glue in the point and push it on the shaft. Then stand the dart on a hard surface and push down to seat it firmly.



You can't really wrap these points on very well, but it may give you a little more reinforcement. And you want to use a tapered shape rather than a straight peg -- a peg has a weak spot where it joins the larger part, and the tip will snap off. A tapered end has more strength.

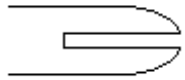
I like to use tapered target arrow points on my darts. They stay sharp forever and add quite a bit of weight to the tip. They will come off occasionally, though, so keep the glue handy!

Flat Points:

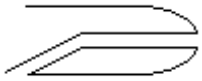


These are points that are flat in cross-section, no matter how wide or long they are. Stone projectile points fall in this category, as well as ones made of bone, wood, and metal.

First, you'll need to round off or bevel the end of the shaft so there aren't abrupt "shoulders" where the point is attached. After that, there are two different ways to attach flat points to a shaft..



The first and simplest way is by notching the end of the shaft. Using a knife or saw, cut a groove wide enough for the point to slide in easily and deep enough so that the notches of the point are 1/4" to 1/2" below the end. Put some glue in the groove and slide the point in, then wrap it securely.



The second way is by splitting a chip off the shaft. Cut a groove just like above, then cut it off at a slant an inch or so down the shaft. Put glue on, put the tip in, then put the chip back on and wrap it **very** securely into place, going 1/2" or so below the bottom of the split.

The split-chip method has been found on ancient shafts, and while it may not be as secure as the groove, there is a reason for it. With the groove, every time you hit something the point will be jammed back against the shaft, which will cause it to split after time. With the split-chip method, the force of the impact is directed outward at an angle, which will wear out the wrapping but will preserve the shaft. This is also a good thing to know if you start out trying to cut a groove but end up splitting a chip off accidentally.

Fletching:

Fletching is the act of putting the feathers on the shaft of the dart. It serves two purposes:

1) It stabilizes the dart in flight by splitting the airflow, like the wings of a plane.

2) It creates drag on the rear of the dart, forcing it to travel slower than the tip, which keeps it straight.

In addition, if you use a fletching style that twists the vanes, it will cause the dart to spin (like a bullet) which also keeps it straight. This creates extra drag, however, which reduces the velocity and distance.

That's the problem - more fletching means more stability, so a dart will fly straighter. It **also** means more drag, so the dart won't travel as far or as fast. Less fletching means less drag, so the dart will go farther and faster. It won't stabilize as quickly, though. That's why fletching is the hardest part of the dart to fine-tune -- it's a matter of finding the right combination of stability and drag for **that particular dart**.

You don't really **need** to fine-tune it, though. Most darts end up overfletched somewhat, but unless you're throwing for distance, overfletched darts works fine. In fact, there's a type of arrow called a "flu-flu" that is deliberately (and massively) overfletched, used for hunting birds in flight. It goes straight and fast for about 20 yards, then stalls and falls to the ground when the drag takes hold. I don't think it is possible to overfletch a dart that much, so don't worry about it.

Underfletching, on the other hand, is much more serious. The dart won't stabilize and there won't be enough drag to keep it straight. If you're in doubt, use more or larger feathers.

I'll be using a few different terms when talking about feathers, and it doesn't hurt to explain them. The **spine** of the feather is the hard part running down the center. The **quill** is the exposed part of the spine which used to be attached to the bird. The **vanes** are the "feathery" part of the feather (sorry, I don't know how to explain it any better).

Feathers to Use:

Any feather that is large enough (at least 5" of vanes, at least 1" wide) will work. Larger feathers tend to work better, though, because there's more room for adjustment. You can always make a feather shorter or thinner. If it's too small, though, all you can do is add more feathers, and there's only so much room on a shaft. Turkey and goose feathers tend to be best because of their size.

It's important to use feathers from the same wing (curving in the same direction). They will give the dart a little spin naturally, and if you mix right-wing and left-wing feathers, it can make the dart wobble.

Placement:

How far down the shaft you place the feathers is up to you. Some people put them right up against the nock end; others like it a few inches farther down. As long as the wrapping on the bottom of the fletching is clear of your grip on the atlatl, it will work.

Fletching Styles:

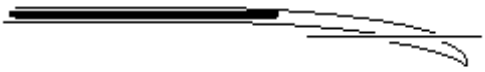
Although we don't know for sure what kind of fletching ancient peoples used, we know how arrows have been fletched and what works on darts. There are two basic styles -- split-feather and whole-feather.

Split-Feather is the kind of fletching used on arrows. The feather is split along the spine, and the resulting vanes are glued or wrapped onto the shaft.

I don't believe that this method was ever used on ancient darts, though. Splitting the feathers takes extra effort, more time, more glue, and more feathers, and it doesn't give any benefit to a dart. Split-feather vanes came about for use on arrows -- they had to be offset so they wouldn't drag along the bow when they were fired. This isn't a problem on atlatls, though. With that in mind, I'm not going to cover it. If you want to use split-feathers vanes, you can find out how in an arrow-making book.

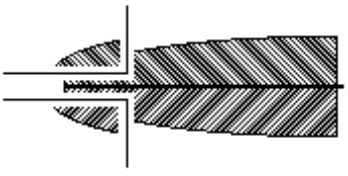
Whole-Feather means just that -- you use complete feathers for the fletching. You can use one large feather or 2 or 3 smaller ones (make **sure** they're the same size!) to get the same total fletching area. It's up to you.

First, you'll need to cut the quill down to about 1" long (from the bottom of the vanes). Then take a knife or scissors and cut off the bottom side of the quill. This will give you a flat surface to lay on the shaft, which keeps the feather in place during wrapping and gluing.



You will always need to wrap the quill to the shaft, and if you're using one feather, you'll need to wrap the tip as well. With two feathers, you can choose whether or not to wrap the tip; with three feathers, there isn't enough room on the shaft for it.

To prepare the tip for wrapping, take your scissors and **carefully** cut down from the end of the feather on both sides of the spine, then cut in from the sides. You'll want to go at least 1/2" down to give yourself enough spine to wrap.



After you've decided on the style, number, and length of the feathers, and have them prepared, it's a good idea to tape them onto the shaft and throw the dart a few times to make sure it flies well. If it wobbles or doesn't straighten out well enough, you don't have enough fletching and need to add another feather or use larger ones.

Attaching the Feathers:

If you're using one feather, lay it on the shaft with the tip as close to the notch as you want. Tape or wrap the tip down, then lay the quill straight down the shaft and tape the bottom. With two feathers, if you're going to wrap the tips do it the same way, making sure the feathers are directly opposite each other.

If you're not going to wrap the tips, or are using three feathers, put the tip of one feather about 1" below the nock and hold it in place. Straighten the feather and mark where the bottom of the quill comes to. Start taping it there, then add the other feathers so they're spaced evenly around the shaft. Just let the tips of the feathers curve around the side.

After testing it out, If you're happy with the way the dart flies just remove the tape and wrap the feathers in place permanently. A spot of glue on the quill (and the tip, if you need it) is a good idea to hold it in place during wrapping. You should cover the entire quill on the bottom and the exposed spine on the top to make sure it's secure.

The Nock:

This is the end of the dart that the atlatl peg fits into. I've never known the official term for it (besides the "dimple"), so I use **nock** just because most people will understand what I mean.

If you're using a tapered shaft, make sure you're using the narrow end for the nock.

You should wrap the last 1/2" of the shaft on the nock end (you may have already done this while attaching the fletching). Every time you throw, pressure is put on the shaft here and it will split or crack very easily. Wrapping will hold the fibers together, distributing the stress over a wider area and keeping the nock from breaking.

If you're using rivercane or bamboo, and the nock isn't on a node, you're done! Since they are naturally hollow, you should have a nice dimple already waiting for you. As long as it's wide enough for the peg of your atlatl, you don't need to do anything else.

If you're using wood, or if the nock **is** on a node, you'll need to drill it somehow. You don't have to down go very far at all -- usually 1/8" is sufficient. There are a number of ways to do it. You can touch it **very** lightly with a hand drill, use a stone-tipped drill for authenticity, or simply use your knife. Put the tip of the knife into the center of the shaft and rotate it around until the hole is wide and deep enough to engage the peg.

Summary:

Congratulations! You now have all the information you need to make a dart from any material that fits the parameters. It's a lot of information and can be very confusing until you actually put one together, but as you actually start making darts you'll find out that everything falls into place nicely.

You'll also find out what steps you can leave out. If you're using rivercane or bamboo, you don't really need to strip it, smooth it, or sand it. If your shaft has the correct spine and is straight, you can skip those steps as well. And on my darts, I almost never wrap the nock end (and end up with a few broken nocks as a result).

On the following pages, I've given some examples from darts I've made. You can follow the process through from beginning to end and see how it all goes together.

Happy throwing!