DARTS: HOW THEY WORK, HOW TO MAKE THEM

By Ray Strischek

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Dart:

Material Length Weight Center Point / Balance Point Fletching Cup Flexibility

Too: Long or Short >>>>----------/----------/----------->
Thin or Thick Flexible Center Balance Stiff
Stiff or Springy Point Point
Heavy or Light
Point End Heavy or Judiciously Distributed Weight Throughout Length of Dart Shaft.

Correlations between: Dart Length and Atlatl Length
Dart Weight and Atlatl Weight
Dart Flex and Atlatl Flex (Rigid, flexible, elastic atlatls)
Dart Flex and weighted versus un-weighted atlatls

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THE DART:

So why don't they call it a spear? I don't know. I don't know anyone who does know. All I know is that a dart is **intentionally quite flexible**, and a spear (the jabbing, thrusting kind) wasn't meant to be but sometimes is **a little flexible** for hand thrown spear purposes (RE: the Javelin in the Olympics).

A good dart is flexible.

In fact, a non-flexible spear will not even work with an atlatl. As the cast is made, the point end goes immediately and extremely vertical, and then falls back out of the sky the same way.

Because the shorter atlatl is levering and moving forward faster than the longer flexible dart, the dart bends, flexes, basically trying to get out of the way of the oncoming atlatl. Thus flexed, the dart shaft has stored up kinetic energy so that when the dart actually separates from (springs off of) the atlatl, the **kinetic energy thus stored in the flexing dart is released,** added to energy of the human provided **force of throw** and the human provided **torque from the flicking wrist** at the end of the cast, all of which gives the dart its sum total of distance and penetration, and its wobble/snake like travel through the air.

How flexible should a dart be?

Here's a simple field test that works for darts 6 to 8 feet in length. Hold the dart with one hand at the butt end of the dart. With the other hand, hold the dart two feet from the butt end. Hold the dart chest high and horizontal. **Moderately wag the front end of the dart up and down**. If the front

end wags (flexes) up and down between 12 and 24 inches distance, the flex of the dart is useful. More than that, and you might as well be trying to cast wet spaghetti. Less than that will demand a lot of force of throw, a lot of weight up front, a lot of fletching, or be so stiff as to be useless. For darts 5 to 6 feet in length, the **range of wag (the "wag test")** should be 8 to 18 inches. As my personal bias is for longer darts, I consider any dart less than 5 feet long to be useless no matter what its range of wag is.

If you have a dart that works really well for you, do this simple **"bend test"**: Lay two feet of the point end of the dart on a table so that the rest of the dart is hanging off the table. Put a concrete block or other heavy weight on that part of the dart lying on the table. At the rear of the dart (hanging off the table) tie on a specific weight, say perhaps a half pound or a soft ball or a shoe. Measure the deflection, the distance from dart level and straight, to dart bent by the weight. Try to make all your darts just like that one, same diameter, same length, same weight, same fletching, and, same amount of distance in the **"bend test"**. And no, it won't be easy. Generally, out of every 10 cane dart shafts, I can make 3 that are about the same. Consistency is easier to find with one diameter wood shafts or mass produced aluminum tubing.

It is a personal preference issue as to how much flex is good for the individual atlatlist; something learned from practice and experimentation over a period of time. I tend to prefer stiffer darts, wag range of 12 to 18 inches, for my 8 foot darts. Most other atlatlists tend towards more flexible darts in the 16 to 24 inch wag range.

Richard Lyons of Jeffersonville Indiana invented a sort of dart stress test rack. A length of wood marked off in the metric system stands vertical. The dart point sets on a base at the bottom. A cap above is pulled down onto the butt end of the dart. The pull string is tied to a measuring device. Pull the cord and the dart is compressed until it begins to flex and thus the "spine" strength of the dart is measured. Call this the **"spine test"**.

The end result is the same as with the "wag" and "bend" tests. Find a means of comparing darts for the purpose of obtaining a **matched set of darts**. Consistency, the key ingredient of accuracy is easier to obtain when practicing with multiple darts that are relatively the same.

Here's the problematic deal for dart flex:

First: **Flexible means the darts bends**.

Kinetic flexibility speaks to the issue of how fast a dart snaps back to its original straight self after being flexed.

By way of example: Aluminum, Plexiglas, and Bamboo darts have more kinetic flexibility than River Cane and Wood darts. Slight changes in the force of throw create a much more dramatic and immediate change in dart flight behavior with aluminum, plexiglas, and bamboo, than with river cane and wood. By comparison, river cane and wood are almost user friendly in that slight changes in the force of throw will not much effect dart flight behavior.

Below is an "in-my-opinion" chart of the kinetic flexibility "merits" of various dart shaft materials:

Material	Quality	Usability
Single Diameter Aluminum Shafts:	Hyper Kinetic	Serviceable
Single Diameter Wood Shafts:	Wobble Wobble	I threw all mine away.
Single Diameter Carbon Shafts:	Wobble Kinetic	Serviceable Plus
Bamboo Shafts	Briskly Kinetic	Good Stuff, Man.
River Cane Shafts	Fine and Dandy Kinetic	My Favorite
Fiberglass Fishing Pole Shafts:	Fine and Dandy Kinetic	User Friendly
Tapered Wood Shafts	Fine and Dandy Kinetic	User Friendly
Re-packaged Aluminum Shafts *	Briskly Kinetic	People I Know Love It.
Other	Unknown	Unknown

* Re-packaged aluminum shafts. Several modern atlatlists have fooled around with single diameter aluminum shafts in order to make **"good darts"** out of them.

Unlike the bow and arrow, for which thousands of devotees have recorded every word ever spoken on the subject, and, spent their whole lives and fortunes re-engineering the original design, the atlatl and dart has very little recorded history, and, almost everything we know, comes from a trade off between archaeological fiend notes and "what it is and where I found it" archaeological articles, and, word of mouth experiences from modern atlatl enthusiasts.

WHAT IS A GOOD DART?

A good dart has a balance point 6 to 10 inches forward of center, and, the front 1/3 of the shaft is stiffer than the rear 2/3s of the dart in order to confine the flexing to the rear 2/3s of the dart.

Bamboo and River Cane grow that way naturally. Wood can be tapered that way. Here are the most successful tricks to make those one diameter aluminum dart shafts behave like real darts.

1. Put a smaller diameter aluminum shaft(s) inside the front 1/3 section of the aluminum dart. This stiffens up the front 1/3 of the shaft, and moves the balance point of shaft forward.

2. Put a wooden dowel rod inside the front 1/3 of the aluminum dart. This stiffens up the front 1/3 of the dart and, being heavier than a smaller diameter aluminum shaft, moves the balance point even further forward.

3. Wrap cotton string around the outside of the forward 1/3 section of the dart, and put two or three layers of glue on the string with a tooth brush. Then paint the glue to make it water proof. The weight of string/glue/paint moves the balance point forward, but stiffens up the 1/3 front end only slightly. The maximum benefit of this trick is making the dart shaft wider, for ISAC target competition purposes.

Second: On the other hand, **any dart can be over flexed** if the casting motion is a hyper active, furiously fast, whip, snap action. Over flexing the dart can cause it to react (flex back) in an uncontrollable manner (dart does not flex back on track to the target), or, the dart simply snaps, shatters, splinters, breaks in two.

I have witnessed several times, as persons new to atlatling, cast so hard and fast that the dart actually snaps in two. Most times, hard and fast will simply send the dart curving away from the

target, as hard and fast will almost always impair good casting technique by either causing the wrist to turn outward before the dart separates from the atlatl (dart goes off target), or causing the hyper active atlatlist to subsequently bend forward at the waist and/or drop his/her elbow below the shoulder line **before the dart separates from the atlatl** (causing dart point to drop and darts hits dirt in front of the target. I will cover this subject again in the section on Atlatl and Dart Technique.)

A good casting motion is one of momentum building up to the brisk flick of the wrist at the end of the throw. Good accuracy depends on a momentum building casting motion that flexes the dart into a complimentary level of stored energy that will produce a predictable and controllable flexing dart flight behavior. It should be noted that the force of throw, which will effect how much a dart flexes, must be adjusted for distance to the target. Therefore, the range of kinetic flexibility of the dart being used must be variable enough to accommodate changes in the force of throw from **gentle at 10 meters** distance to the target, through **strenuous at 30 meters** distance.

SELF DARTS AND DARTS WITH FORESHAFTS
BALANCE POINT OF THE DART
RIGID FORWARD SECTION OF THE DART

In the archeological record, darts are anywhere from 4 feet long to 13 feet long, fletched or un-fletched. Dart shaft materials are generally wood or bamboo, but also river cane (the American home grown version of bamboo) reeds, rushes and combinations there in.

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Darts are missiles. They carry a payload, the point, sharp or blunted, pronged or barbed, depending on what's being hunted.

FORESHAFT: A dart can have its point mounted directly to the dart shaft, or indirectly by means of a fore shaft. A fore shaft is a length of rod 6 to 18 inches in length generally, (bone or wood) which is inserted into a hollow tube shaped or long cone shaped **socket** reamed or drilled into the front end of the dart shaft itself. The other end of the fore shaft holds the point.

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The fore shaft fits snugly but not in anyway permanently into the dart shaft. The purpose is that when the dart hits the target animal, the animal flails around and the dart shaft separates from the impaled fore shaft, and falls to the ground. The hunter picks up the dart shaft, and from a carrying case, pulls another fore shaft and inserts it into the dart's fore shaft socket, ready for another throw. Thus, the hunter is freed from having to carry more than 1 or 2 dart shafts on the hunt.

With the self dart, every time the dart is thrown, its gone and useless until retrieved, becomes increasingly shorter every time the point breaks, or is gone forever if mangled in the target's death throes. And, in theory any way, the hunter has to carry more darts with him on a hunt.

DART BALANCE POINT:

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center point

The length of a dart obviously has a **center point**. But, assuming the point is heavier than the fletching, the **balance point** will be **forward of center** towards the front or point end of the dart. And, if a dart is made out of bamboo, which grows bigger at one end than the other, and assuming that the big end of the bamboo is where the point is going to be, the balance point of the dart will be even more **forward of center**.

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balance point

A good dart has its balance point forward of center.

The ideal perfect throw, is a horizontal throw from point A to point B. But this is the real world and a dart has weight and is subject to the laws of gravity. Therefore, the best we can hope for is a not too steep trajectory that can be calculated into the aim/throw/hit mechanics of the cast.

A center balanced dart with a one diameter dart shaft will fly to the target with its point in the air, with the point dropping eventually, due only to the fletching at the rear of the dart acting as drag.

A forward of center balanced dart will arc, point up above the fletching at the start of the flight, point below the fletching at the end of the flight.

A dart with its balance point way far forward of center will require a much steeper arc and more force of throw, to travel the same distance as a dart with its balance point just a little forward of center.

The archeological record, overall, puts the balance point of the dart in the forward 30 percent of the darts length.

A good rule of thumb is to have the balance point of the dart be 6 to 10 inches forward of center, depending on the length of the dart (assuming dart lengths of 5 to 8 feet)

RIGID FORWARD OF CENTER:

A good dart restricts the flexing to the rear two thirds of the dart.

A single diameter dart flexes in the middle of the dart shaft, with the front end (the end with the point) wagging up and down as much as the back end during the flight. Will the point of the dart hit a 10 or an 8? It's kind of problematic, as front and rear are generally still wagging when the dart gets to the target.

Bamboo and River Cane darts, because they are fat at one end (the point end) and skinny at the other (the butt end) confine the flexing to the rear 2/3 of the dart shaft, because the front 1/3 of the dart is stiffer as well as fatter. The front end of the dart is no longer wagging when it gets to the target.

A good dart <u>does not</u> have its forward of center weight all piled up in the point end of the dart. The forward of center weight of the dart should be and evenly as possible, distributed through out the entire 1/3 forward section. This is what makes bamboo, river cane, tapered wooden darts and darts made from tapered fiberglass fishing poles better dart shaft materials.

A dart that has a disproportional amount of its forward of center weight piled into the point end of the dart, will be a dart which requires a much higher trajectory flight plan because the front end will tend to want to drop like a rock. (The good news, I guess, is that such a dart will require less fletching.)

FLETCHING:

Fletching refers to the feathers glued or tied or glued and tied to the butt end of the dart. Fletching is a drag, in the sense that it's a drag on dart flight. Ask yourself this: what would happen if you tied a concrete block on to the spur end of the atlatl. Would you gain velocity, lose velocity, or never get the atlatl off the ground? Now, for the sake of fletching, try to imagine tying a kid's toy parachute on to the butt end of the dart and imagine what that might do to dart flight velocity. And now imagine tying a real parachute on to the end of the dart's butt and imagine what that would do to dart flight velocity.

In a way, fletching acts like a parachute. It slows down dart flight velocity. The bigger, the more of, the fluffier the fletching, the slower the dart travels. Big and fluffy also makes a lot of noise.

On the other hand, **fletching helps stabilize the flight of the dart**. Earlier, I stated that **a good dart has its balance point 6 to 10 inches forward of center**, and, the more forward of center the weight is, the more likely the dart will need a higher trajectory and the quicker the point end will drop out of the sky.
It is also true, that the more forward of center the balance point of the dart is, the less fletching is needed to stabilize the flight of the dart. Ray Madden of Joplin Missouri is a constant experimenter with un-fletched darts. He is quite able to throw good scores at ISAC targets with darts that have no fletching. He will be the first to tell you that a whole lot more control is needed to cast darts without fletching.

<u>I digress</u>.

Hooking: (**Side Arming:**) Sorry, but it is necessary to discuss this term "hooking" in order to understand what goes wrong most often with casting un-fletched darts. I have always thought of "hooking" as referring to a bad spur design in which the tip of the spur is not a "ball and socket" fit to the "cup" or hole in the butt end of the dart.

In my Atlatl/Dart primer, one hooks the dart when the spur tip is so pointy that instead of sweetly rotating into and out of the dart butt's hole, it hooks (like Captain Hook) on to the inside lip of the dart butt's hole and hangs on for dear life, **thus causing a significant disruption in the normal mechanics of the throw.** "He hooked that shot." "Yeah, he liked to tore that dart a new butt hole."

However, as has been pointed out to me on numerous occasions, to the point of near persecution, by other atlatlists, **"hooking"** merely refers to the **"natural"** right hand curve of the flight plan (if

you are right handed) or the **"natural"** left hand curve of the flight plan (if you are left handed) brought about by **a side arm technique of casting**. Like hitting that curve to the sweet spot in bowling, I guess. Watch out for the gutter!

A side arm throw has **the flailing/hinged upper arm-elbow-fore arm-wrist-fingers movements**, moving forward in a diagonal motion (as viewed by anyone watching the atlatlist from the rear). An end over end throw has the flailing/hinged upper arm-elbow-fore arm-writs-fingers movements, moving forward in a vertical motion. End over end throwing sends the dart straight to the target, no curving. You can read all about this in the up coming Throwing Technique section.

Suffice to say, that end over end throwing requires less fletching to stabilize the flight of the dart because less hooking (in the side arm atlatlists' sense of the word) is involved in the throwing technique.

Also, the more absolute, total control you have over the throwing motion, the less fletching will be needed.

Also, the more forward of center the balance point of your dart is, the less fletching will be needed.

And so, after explaining all this, you might wisely still ask, "So, Mister Expert, how long and fluffy should my feathers be?"

To which I might say "Somewhere between nothing at all and the size of an Army parachute".

OK, I'm back.

Two feathers actually work to more or less stabilize a dart's flight, but, I've never seen anyone score very high in a WAA ISAC contest using a dart with only two feathers for fletching.

Three feathers work even better.

Four feathers work even better than three, and, for obvious reasons, four feathers are easier to accurately align on a dart, than three.

For the beginner, I would recommend using **four feathers, 6 to 8 inches in length, trimmed to about 3/4s of an inch to 1 inch of feather width**. The same glue used to glue feathers on arrows works just fine with feathers on darts. **Leave about an inch of quill front and back to for lashing** as glued- on- only feathers on darts peel away from the dart sooner or later, perhaps because they are bigger and thus more subject to the elements than the neatly trimmed little arrow feathers. The feathers should be attached about two inches forward of the darts rear end.

The more control over throwing technique is gained, the less fletching will be needed. The less fletching needed translates into increased velocity. Better control also means better accuracy and a 90 or better in the WAA ISAC.

Here's a clue that you need more fletching or better control of your throwing technique: The rear end of the dart significantly fish tails on its way to the target. Or, the dart flies somewhat sideways

or diagonally all the way to the target.

MAKING A GOOD DART:

My first experience in making a dart had me spending hours in the woods searching for saplings long and straight enough, and, thin enough to be made into darts just by cutting off the branches and top. Over a two or three day period I found about two dozen likely prospects of beech, maple, oak, cherry and poplar. I bundled them up and took them home. I put them in my attic to dry.

At the same time, a friend of mine had cut down his rather large bamboo stash the winter before and left them leaning against his barn. I begged for some handouts. He said take all you want. And I did.

While waiting for the saplings to dry (8 weeks), I started to straighten the bamboo, which were already dry as they had been leaning up against my friend's barn all winter. This is the process:

1. Clear out room, enough room to whirl 8 foot dart shaft around.
2. In center of room, put stool.
3. On top of stool, put an electric hot plate. Plug in hot plate. Put on high heat.
4. Put on thick leather gloves.
5. Grasp bamboo in both hands. Starting with the nodes (dividing sections on bamboo), hold the bamboo one half inch above the hot plate and slowly rotate the bamboo over the heat.

   In about 30 seconds, the section you are heating will be hot enough to bend.

   Use the pressure of your thumbs to bend the hottest spot straight. Hold in place for 3 to 5 seconds.
6. Repeat heating and straightening process at each node, then for each section between the nodes. It takes about 20 minutes to straighten a 6 foot section of bamboo.

Tip of the day: Thicker bamboo will require more heating time than thinner bamboo.

Second Tip of the day: When bending bamboo at a joint (node), be sure to bend it a little beyond straight the first time. Bamboo will bend back a little. The thicker the piece, the more it will bend back the first time. Therefore, don't be afraid to go a little beyond straight the first time you straighten bamboo at a joint (node).

Eight weeks later I was able to start straightening the wooden sapling dart shafts. This was the process for that:

1. Clear out room, enough room to whirl 6 foot dart shaft around. (I was never able to find any saplings longer than 6 feet that were within the WAA ISAC dimension rules (shaft under 19 mm, less than 3/4 of an inch diameter).
2. Set up stool.
3. Put hot plate on stool, plug in hot plate.
4. Strip bark off of saplings.
5. Un-plug hot plate as stripping off bark is taking longer than I could possibly imagine.
6. Plug hot plate back in.
7. Coat sapling with paraffin (or bee's wax or bacon grease or other oily substance as

recommended by any number of arrow straightening how-to books.)

8. Using thick leather gloves and thumb pressure, heat and bend shaft straight. Numerous coatings of grease will be necessary. Room will fill with burnt grease smell.

9. Repeat grease, heat, and straighten process for each wooden dart shaft everyday for the rest of your life. (As you heat the shaft the grease gets hot, it boils, it splatters, it smokes, and it seems like its boiling into the cell structure of the wood itself. You have to heat for 30 to 40 seconds, rotating the shaft as you go. When you bend it straight you have to hold it in place for 10 seconds or more because unlike cane, saplings are not hollow. Saplings are solid, much more demanding. When they were thinking up the term **"labor intensive"**, straightening saplings was what they had in mind. **Not recommended for couch potatoes**.)

(No kidding folks. Saplings suck. Worse than that, the oak saplings were so brittle they broke after only 20 or 30 throws. The maple were too heavy. The Cherry had the memory of an elephant and would never stay straight for more than 5 seconds. All and all, out of 24 saplings I was able to make only 8 useable dart shafts, all beech and maple. They were OK darts. But if I left them leaning against a wall over night, they remembered they were supposed to be growing like a cork screw in the woods and assumed that position by morning, which means that they needed straightening all over again.)

How to make better wooden darts:

1. Buy **straight grained**, kiln dried boards of cedar or beech, nominally 1 inch thick by 7 - 8 feet long.
2. On a table saw, "rip" the boards downs to 3/4 x 3/4 inch by 7 or 8 foot long strips.
3. Using a planer, turn the 4 sided strips into 8 sided strips.

By the time you have sanded and rounded off the 8 sided edges, your shaft will be less than 3/4 x 3/4 of an inch in diameter and therefore, be ISAC legal.

4. If you don't have any kiln dried lumber, no table saw, no planer, and no skill, contact The World Atlatl Association for a list of dart makers and buy ready made wooden darts from them.

Tip of the day: The trick is to use STRAIGHT GRAINED wood. If after ripping the wood down to 3/4 " by 3/4", the piece curves, THROW IT AWAY. YOU DON"T WANT THAT ONE. Use the ones that start off straight or nearly so from the very start, and all on their own, pretty much stay straight. . Be prepared to have to straighten and occasionally re-straighten,,,,,, or,,,,,, learn to throw such darts "crown" side up. Seal the surface of wooden darts with polyurethane.

Wooden darts, especially un-sealed ones, don't hold up well in the rain. They go limp, they curve and cork screw, become not straight.

River Cane and Bamboo darts hold up much better in the rain, though thick walled River Cane does tend to bend out of straight when left in the rain too long.

Aluminum darts:

1. Go to archery store.
2. Buy arrow stock, the widest gauge (28 gauge) they have. For each dart, you will need three arrows. Buy a fourth arrow that is a smaller diameter than the others.

3. Go to plumbing store, buy little red pipe cutter.

4. Cut the smaller diameter arrow into two, 6 inch long sections to be used as an inside coupler for the bigger diameter arrows.

Use the remaining smaller diameter shaft to add weight and rigidity to what will be the front end of the dart.

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Insert and glue the smaller diameter pieces into the larger diameter pieces. Leave some room up front for the insert part that holds the screw in point.

5. Using the two smaller diameter couplers and the appropriate metal to metal glue, put three of the bigger diameter arrows together to make one dart shaft.

6. Use the inserts and dart points available for arrows at the archery shop for the same purposes on your dart. Use an extra insert as the cup for the butt end of the dart.

Tip of the day: **Use the widest gauge arrow stock you can find**, if you want good dart shafts over
6 feet in length. Narrow gauge arrow stock over 5 ½ feet in length tends to be too limp, too flexible for the amount of tensile strength available in the aluminum used. Remember, arrow stock is designed for the stress factors of the bow and arrow projectile delivery system, not atlatl and dart.

By and large the easiest dart shaft to make is the multiple aluminum arrow dart shaft. Making dart shafts out of aluminum arrow stock is more expensive, but they are durable and effective.

OR, go to EASTON TUBES: www.eastontubes.com Click on the tube offering page.

At Easton Tubes, you will find a variety of aluminum tubes, 6 feet long (best bet, use the 3/8 inch diameter), for about $5.00 each. You can even get shorter versions, painted black or gold, with extension pieces for about the same price.

These tubes are aluminum tent poles, not arrow stock. Tougher, slightly heavier than arrow stock. Joining a foot long section to the 6 foot section, making a 7 foot dart produces a very good dart shaft. Tough, strong, and relatively kid proof.

Bamboo grows everywhere, and river cane (straighten the same was as bamboo) grows all over the south. Bamboo shafts can be purchased via the internet for as little as 35 cents a piece in lengths of 6 feet if you buy 100 or more. Some department stores (K-Mart) sell bamboo in 7 foot lengths in the lawn and garden section (6 for $5.00) in the spring for use as bean pole and tomato stakes. For river cane, you pretty much have to know somebody or buy a map to that fabled secret stash, or, go to a large flint knapping event, as someone there will probably have 20 to 40 river cane shafts for sale at around $2.00 each. Bamboo and River Cane are more labor intensive than aluminum and do not hold up nearly as long, but, Bamboo and River Cane natural and much more user friendly.

Wooden darts are problematic at best especially if they have one diameter throughout their lengths Tapered wooden darts are fine, if you care to get that labor intensive or can find someone who will

make them for you.

If abused, any dart shaft will break.

ATLATL AND DART RELATIONSHIPS

This should seem obvious but no real scientific experiments have been conducted under controlled circumstances, so evidence to prove or disprove anything is lacking. There does seem to be a working relationship between the length of a dart and the length of the atlatl. There does seem to be a working relationship between the way weight is distributed along the dart shaft and the way weight is distributed along the atlatl shaft. There does seem to be a working relationship between the kinetic flexibility of the dart, and the kinetic flexibility or lack of same of the atlatl. All this of course, is affected by the personality and prowess of the individual atlatlist.

Example: I use darts 7 feet, 10 inches long, which weigh about 5 ounces. My atlatl is a flexible, weighted
Atlatl 23 and one half inches long. The atlatl has one weight at the spur end of the atlatl.

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  Handle--Shaft--------Small Weight--Spur
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Recently, I became envious of other people's well made, 4 ounce, narrow, light weight cane darts, and the ability of other people to cast their darts faster and with a lower trajectory than I can obtain with my "fat boy" darts. **So I made my darts lighter by shortening them 6 inches**, and using copper points that were half the weight of the ones I was using previously. I also switched to shorter feathers and from 3 ply hemp string lashings to thin sail thread lashings.
Altogether, I reduced the weight of my darts by one ounce, moved the balance point of the dart back to within 5 inches of center, and made them 6 inches shorter. From that point on, I could not hit the broad side of a barn. Actually, it wasn't that bad, but the significant increase in bad shots made me feel real bad. I had completely disrupted the working relationship between my atlatl and dart which I had achieved by "blind-pig-in-the-woods", trial and error, over a 10 year period of time. I lost the feel of the weight of the dart out in front of my atlatl. Previously, when I would increase the angle of the dart from horizontal to having the dart point angled up, say 10 degrees above horizontal, the weight of the dart out in front of the atlatl would become less (because the center of the dart's gravity moves to the rear). After "adjusting" my darts, I couldn't feel anything, couldn't feel any difference at any angle. I had lost one of my key registration points in aiming.

The problem? **I had not likewise adjusted my atlatl**. So then I did, by putting a smaller weight on the atlatl shaft.

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What this did. Once again, I once again, had a comfortable amount of **noticeable dart weight** out in front of the handle and just enough weight in the rear by the spur to prevent the flexing dart (during the throwing motion) from kicking back on the spur, and making me wobble the cast. My accuracy is back to where it was, for better or worse.

It was an un-nerving experience. I had always assumed there was a relationship between atlatl and dart. I was just caught off guard as to how severe and demanding it can get.

SUMMARY:

A good dart is, flexible (but not wildly so), is at least as long as you are tall and a little more so, and has a balance point forward of center (varies per individual). The front 1/3 of the dart should be stiffer than the rear 2/3 of the dart so as to confine all the flexing to the rear 2/3 of the dart. A good rule would be to use 4 feathers for fletching, about 6 to 8 inches long by ¾ of an inch wide. Leave 2 inches of dart shaft behind the fletching. The weight of the dart should be between 3 and 6 ounces. Try to make multiple darts all the same, so when you practice, you have the equipment to develop some consistency.

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