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Atlatl Weights: Function and Classification

By William R. Perkins © 1993

Introduction

Atlatl weights, both known and suspected, are a fascinating and frustrating subject. Based solely on the misinterpretation and lack of understanding surrounding them, and their occurrence in the archaeological record debate and confusion as to their purpose has set them apart from most other artifacts.

There are a variety of atlatl weight types and suspected types found, interestingly enough, mainly in the United States. Their distribution seems to be contained within the forty-eight states with a little overlap North into Canada, and south of the Rio Grand River into Mexico. But generally, the political boundaries of the lower 48 United States hold most of the world's atlatl weights. As far as I am aware, atlatl weights do not occur outside North America, although atlatls most certainly do. Atlatls in a variety of styles are found more or less worldwide. The earliest examples date to well over 20,000 BP in Europe, and the atlatl is still used today by natives of Papua, New Guinea, and the Australian aborigines. But regardless of where atlatl are found, nowhere other that North American are they found with weights attached to them.

The confusion surrounding atlatl weights begins with the many theories as to their purpose. The most popular of these seems to be that they are a counter balance. This theory suggests that the weight acts as an adjustment to balance the atlatl and dart in the palm of the hand. Many other theories have been put forth, mainly based on the idea that the attachment of the weight would propel the dart a greater distance.

Experimentation with many of these theories tended to show opposite results until finally the theory of last resort, "hunting magic" was applied. When all else fails, it's a charm, the owner believed the atlatl weight possessed "hunting magic". No doubt about it, some weights are quite beautiful and finely polished, and I am sure their owners even believed that they possessed magical power. That's just the way we humans are. We're weird like that. However, not all atlatl weights are beautiful. Many are rather crudely furnished and some are merely rounded river rock. Even these could hold some special meaning to someone, but the "charm theory" just doesn't hold. Atlatl weights have a function, and that function has to do with their mass.

Weight Theories

This brings us to the contradiction in the term "atlatl-weight". More often than not atlatl weights are referred to in every descriptive term imaginable except-mass. To apply the term 'weight' to an object and neglect to report it's mass would seem illogical to a thinking human.

There is also the confusion of what is an atlatl weight. This is more of a word game that a question of function. Several descriptive and functional names have been applied to known and suspected atlatl weights. Depending upon where you live or how you became familiar with atlatl weights you might refer to all weights in general as Banner Stones, boat stones, counter weights, bird stones, etc. This causes a great deal of confusion. Not long ago I was asking a friend of mine who lives in the East some questions on Banner Stones. Our discussion became quite confused until we realized that I was talking about a very particular type of atlatl weight and he was trying to give me answers for atlatl weights in general.

The center of all this confusion lies with the dispute over the true purpose of the atlatl weight. In my studies of the atlatl and dart I have fond that they possess a deceptively advanced technology. The basic technology, the mechanical foundation of the system, is the flexible dart. Over time humans have tinkered and toyed with the system improving and refining it to a very high degree. There are many levels of technology which have evolved from muzzleloaders, to breach loaders, to lever actions to automatics, atlatl weights in general represent one very advanced level of atlatl and dart system technology. In fact, some weight types represent a higher degree of technology than others do a technology within a technology.

So how is the system improved by the application of the weight? Atlatl weights possess mass and when attached to the experimentation you just can't strap a weight onto any old atlatl and expect a miracle.

Atlatl weights do no possess a sufficient enough mass to significantly influence the speed at which an atlatl is swung in order to affect some degree of timing based on velocity. The fact that a weight increases the moment of inertia of an atlatl is just that, a fact. What good does it do? Why not make thicker atlatls? And as far as a counter balance is concerned, that theory only applies when the atlatl and dart are at rest and not being used. The total system of atlatl and dart, with or without a weight, is fairly light, considerably less than one pound. The presence or absence of an atlatl weight makes no difference whatsoever as to how long or how steady an atlatl and dart can be held. A person can hold the system steadily with or without the weight, for as long as that person can hold it steady. Which is about 6 minutes the last time I tried. After that, your arm cramps and falls asleep, making any attempted throw ridiculously ineffective. So forget about it!

The purpose of the atlatl weights mass is to resist acceleration a review of the technological evolution of the atlatl and dart must come first.

Acceleration

The basic mechanics of the system depend exclusively on the flexibility of the dart. When the dart is accelerated by the atlatl it flexes and stores energy like a spring. At some point during the swing, after the atlatl is no longer accelerating sufficiently to cause further compression of the dart, the dart then uses its stored energy to push itself away from the atlatl. This allows the dart a smooth separation between itself and the atlatl, giving it an effective and powerful launch.

One of the great evolutionary improvements to the system was superimposing flexibility in the atlatl. If this is incorporated successfully into the system, with the degree of flexibility of both atlatl and dart in a functioning relationship with one another, their function will be similar to that of a diver diving from a spring board. In this system the diver's legs are bend, like the dart and store energy to be used to push away from the diving board. The diving board, like a flexible atlatl, is also bent back, storing energy to be used to push the diver away from the board. With the diver and diving board pushing each other away at the same time, the launch of the diver is considerably higher, smother, and more powerful than if the diver had used a fixed, rigid platform.

When the proper mathematical relationships of the length and flexibility between the atlatl and dart are achieved, the results are long and noticeably flexible dart. But the atlatl on the other hand is at approximately one third the length of the dart, short and somewhat stiff. The proper flexibility of an atlatl is rather subtle. The atlatl, which is correctly flexed, seems too stiff to be of any benefit. This is where the atlatl weight is applied to the system.

What atlatl weights accomplish in the system with the flexible atlatl is rather sophisticated and ingenious, representing a level of engineering skill, which is impressive even by today's standards. Its mass, located approximately at the middle of the atlatl shaft, resists acceleration, (Newton's first law of Motion) and forces the atlatl to deflect further that is possible without it. This enables the atlatl to store more spring energy to be used to push the dart away from the atlatl. The weight's position along the atlatl shaft influences the amount and rate at which the spring energy of an atlatl is stored and released against the spring energy of a dart. That is its primary function. Its effects on the system are not so profound as to propel the dart to a noticeably greater distance or velocity, although higher velocities are achieved. (A longer atlatl will noticeably increase the velocity and distance of a dart at the cost of accuracy). When properly incorporated into the system, the atlatl weight improves the performance of that system in terms of efficiency. Smoother, more controlled and powerful launches make for better accuracy. And ultimately it is getting to the target that counts.

Classification

Now that atlatl weight function has been firmly established, the problem of classification can be more easily addressed. Archaeologists have attempted to classify weights according to their shape and hafting technique. In this they have failed miserably. Not only have the same atlatl weights have been placed in a category Type III by one archaeologist and have a Class I category by another but some categories contain only one known example. This being the case I have laid down the framework for a new system of weight classification based solely on function and effect.

The basic atlatl weight, or Type I in Perkins' atlatl weight classification is a single point mass weight with a mass approximately 65 g. Mathematically a mass can be boiled down to one point where its influence is applied to the atlatls flexibility. No matter how it is grooved, holed, shaped, or hafted to the atlatl its final position is that point at which its mass influences the mechanics of the system. Type I has sub-categories of multiple point mass weights. Type Ib would be two point mass weights whose combined mass add up to the approximately 65g. These would be located along the atlatl shaft to render a smoother response to the flex of the atlatl with distributed point masses as opposed to one concentrated mass.

There can be further sub-types with three and even four distributed point masses, but as the base mass of 65 g. is divided the influence of the smaller weights becomes increasingly ineffective.

The improvement over multiple point masses in evolution of this particular technology is the Type II weight. Its mass of approximately 65 g is distributed along its length and, given its unique moment of inertia and method of hafting, influence the atlatls flex at only one significant point. The Type II causes a finer, more precise response to the flex of the atlatl accomplishing with one weight what was attempted with several.

This brings us to the most fascinating weight to be classified. The Type III stealth weight. More commonly known as a Banner Stone, there is some dispute as to whether they are atlatl weights or not. Based mainly on evidence from the Indian Knoll, KY where Banner Stones have been recovered in context and in alignment with atlatl hooks and antler handles, I believe that Banner Stones are indeed atlatl weights. Type III-stealth weights in fact. Their mass tends to be somewhat greater than other weights at approximately 80g, but this can be resolved quite easily when the probable length of the associated atlatls is taken into consideration. Atlatls from the Western United States, which Type II atlatl sights and I tend to represent, are approximately 60 cm in length. Atlatls from the Eastern United States on the other hand, appear to have been somewhat shorter at approximately 40 cm. Not having the mechanical advantage of length, Eastern atlatls seem to have utilized greater mass in order to influence the flex properly.

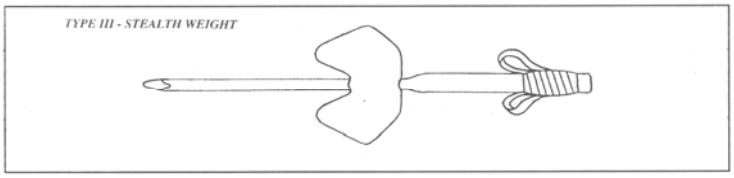
Mechanically the mass of Banner Stones tend to influence the system like a Type I weight, but their shape has the interesting effect of silencing the noise caused by the swing of the atlatl. When a stick or atlatl is swung an audible "zip-like" noise is generated. It seems that when a Banner Stone is attached, this noise is significantly reduced, generating more of a low frequency "woof" as opposed to the high frequency "zip" sound. One would think that because of greater surface area created by the Banner Stone an increase in noise would result. But those who know physics will tell you that what might be expected is not necessarily what occurs.

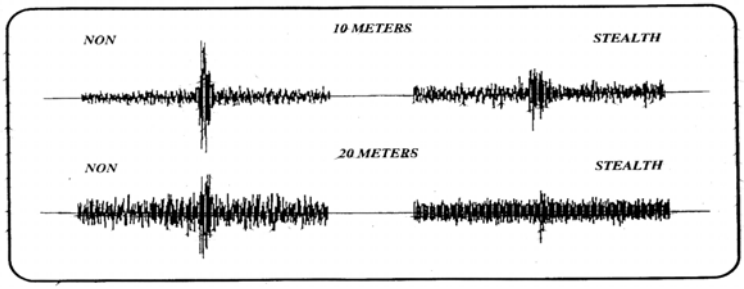
The Experiment

Since first discovering this effect I have demonstrated it to several people. At distances of anywhere from 5 to 15 meters I have asked observers to listen for a difference in sound levels between an atlatl equipped with a Type III stealth weight and atlatl with only a Type I point mass. After three swings with each all observers reported a significant difference in that the stealth atlatl was noticeably quieter than the other was. On the off hand chance that my observers were predisposed to report a difference in sound by being asked to "listen", I began asking subsequent observers to "watch" for a difference between the two test atlatls

The fact that these observers were asked to watch for an effect as opposed to listen resulted in a tendency to be more hesitant when reporting what was noticed after having the atlatls swung in front of them. But again in all cases, they reported that the atlatl with the Banner Stone was considerably quieter than the other atlatl. This result suggested that the effect was so profound that observers, led to believe that they were looking for an effect with their eyes, none the less noticed an effect with their ears.

This type of experimentation being more qualitative than quantitative merely suggests rather than confirms the effect of sound suppression by the Banner Stone weight. That being the case I began to arrange for a low budget electronic sound test to be conducted at the 1992 Rabbit Stick Rendezvous. To my complete surprise, it was arranged to have sound equipment from Ricks College made available to me for this purpose. The equipment provided was so sophisticated that its technology has been available only within the past three years. The microphones, about three feet long and 4 inches in diameter could, on a calm day more, than likely detect the sound of a needle being dropped in a haystack.





For this experiment, the same two atlatls were used as for observational studies. Starting at 5 meters and increasing the distance five meters at a time to total of 25 meters, each atlatl was swung three times with and without the use of darts. A total or ten separate comparisons were made and recorded on magnetic tape. The five comparisons made shooting darts over the head of the technician handling the microphone were noted, for the record, as all traveling approximately the same distance. This was done in case it was suggested (as it subsequently was) that I was swinging the Stealth atlatl differently from the other atlatl.

All things considered, the deviation in throwing was held to an absolute minimum. In fact, I maintained a degree of consistency surprising even to myself, since I was concentrating on NOT hitting the soundman more than anything else during this portion of the experiment. None the less, it should be noted that all darts traveled over the head and landed behind this trusting sole at a surprisingly consistent height and distance respectively.

The Outcome

Computer analyzed the data recorded on tape, and for all ten comparisons the Stealth atlatl registered significantly lower sound levels than the unsilenced atlatl.

Although a mathematical module of this effect has not yet been formulated, the focus of maximum sound suppression seems to be between 20 and 25 meters, indicating an effect known as superposition of sound waves. But no matter what the mathematics are the effect is definitely present.

Although these experiments may not confirm that the effect of sound suppression was the purposeful function related to the shape of Banner Stones the certainly go a long way to indicate it. And as far as the actual advantage of noiseless atlatls is concerned, I will leave that to other researchers to contemplate, since they no longer have "counter balance" theory to consider.

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