The ATLATL

THE NEWSLETTER OF THE WORLD ATLATL ASSOCIATION, INC.
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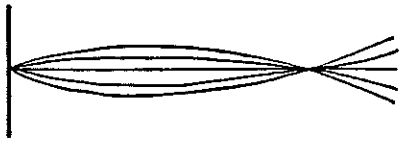
PART II

THE WEIGHTED ATLATL AND DART: A DECEPTIVELY COMPLICATED MECHANICAL SYSTEM.

by
WILLIAM R. PERKINS
and
PAUL LEININGER

The dart acts as a flexible medium fixed at one end which can sustain harmonic oscillations and propogate transverse waves. When fixed at one end, as when in contact with the atlatl, a standing wave can be generated with the third harmonic dominating. This is characteristic of any flexible length constrained in such a manner.

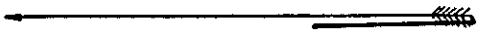


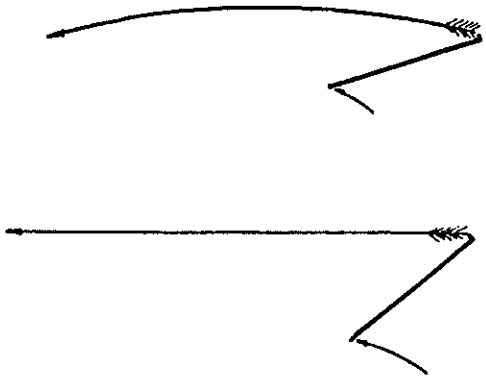
Standing waves are produced when the initial wavefront reaches the end of the dart and reflects back toward the atlatl. The original wavefront will then meet and collide with its own trail of waves travelling away from the atlatl. The superposition of these waves moving in opposite directions creates the phenomenon known as standing waves. Standing waves have nodes, which are points of no movement, and antinodes, which are points of maximum movement. This third harmonic oscillation has two nodes and two antinodes. The first node on a dart is at the back end where it contacts the atlatl. The atlatl constrains it from all transverse movement, so it has to be a node. As we travel down the dart, we will get to an antinode and then the other node and finally to the tip which is the other antinode.

The flexibility of the dart allows it to store energy during the swing, then use that energy towards the end of the swing to push away from the atlatl like a spring. When accelerated by the atlatl, the dart compresses and extends. When it extends, it is actually

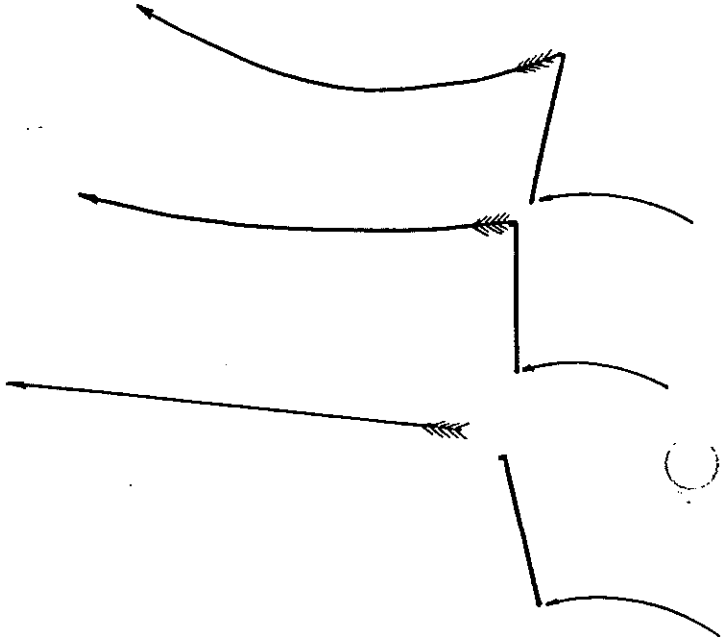
jumping, similar to a person's legs extending during the act of jumping into the air. The dart's motion is in actuality, more complex because it goes through cycles of oscillation, compressing and extending more than once, which is more accurately analyzed as harmonic wave propagation.

When accelerated by the atlatl, a transverse wave is generated which travels along the shaft of the dart. This wave goes through a cycle of harmonic oscillations, gaining a tremendous amount of energy as the dart's speed is increased. For now, consider the atlatl only as a launching platform being accelerated. Upon the initial acceleration, a wave is produced which travels down the shaft. The wave reaches the end and is reflected back to its source, the atlatl spur.

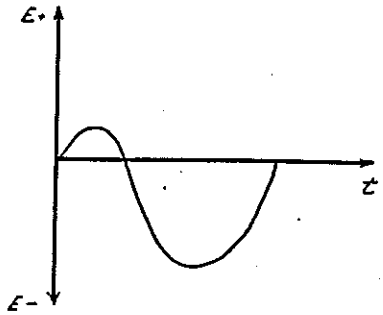




When the wave returns to the spur, the system is still under acceleration, so the wave inverts and travels down the shaft again, producing the third harmonic standing wave and gaining more energy. When the antinodes of the standing wave pass through zero amplitude, the system is no longer increasing in speed enough to sustain another cycle of oscillation. The stored energy of the wave is then used to accelerate the dart away from the atlatl.



The entire sequence, from initiation to launch, occurs in less than 1/10 of a second. The graph shows, in terms of time and energy, the cycle of oscillations that the dart experiences and becomes more significant later when compared with the atlatl's energy.



A flexible dart is a mechanical system capable of undulating potential and kinetic energy. It must sustain its cycle of waves during the time it takes to swing the atlatl. A dart must be constructed such that is flexes at the correct speed. The speed at which this system will oscillate is dependant upon its length, mass distribution, and the spring force it possesses. When these three specifications are in a functioning relationship, we say that the dart is properly tuned.

In dart construction, it is easier to think of this projectile as a very long spring rather than a wave medium. When accelerated at one end, a spring will compress, store energy, and release that energy if the system decelerates, as will a dart.

Mass distribution plays a critical role in speed and the amount of energy that is stored. The dart has mass dispersed along its length. The mass of the projectile point is, however, the most important consideration. The dart point acts upon the system by resisting acceleration, initiating the oscillations, and compressing the dart during the swing. The mass of the dart also resists acceleration along its length, helping the projectile to flex and compress, but the point mass itself plays a more vital role in determining the magnitude of the initial undulation. When the point is absent from the system there is no longer sufficient resistance in order to begin and complete the cycle. We have found that a projectile point mass as small as 3 grams will be adequate, so long as the dart is correspondingly light and flexible. Experimentally, we've discovered that a mass of approximately 5 grams functions best with the wooden darts that we use.

The proper mass of a dart is generally an ambiguous problem dependant on the density of the material being used and its spring properties. Physicists like to dream of the massless spring and its ideal effects upon a system, and indeed, a massless dart could probably propel a 5 gram projectile point to an effective velocity. in reality, however, we are restricted to real mass in real structures. Different materials will oscillate at different frequencies.

In our experiments, we used locally available material in the form of young saplings gathered along the Gallatin River. One species, Red Osier Dogwood, became our preferred wood. Its density is 0.6 kg/1. A five foot dart will weigh approximately 100 grams. Any generally accepted material will make a suitable dart, the parameters in this case being a density of approximately 0.6 kg/1.

The less mass a dart has, the better, but adjustments can be made to create the correct flexibility in heavier material. By shortening, the dart can be made stiffer, and by thinning, it can be made more pliable. Our Red Osier

Dogwood darts are approximately 160 cm in length and about 1 cm in diameter, overall. This produces a dart that is quite flexible, capable of compressing its overall length by more that 30 cm before it deforms and breaks, storing more energy than required. Basically, the dart is a missile which works very much like a spring. Its overall mass is about 100 grams with 5 grams concentrated at the foreward end. Its end-to-end measurement is approximately 160 cm, and it is capable, under acceleration, of compressing and storing vast amounts of potential energy. As the increase in speed declines, the dart uses its stored energy to recoil away from the launching platform of the atlatl. When the projectile extends, it is moving some of its mass forward. Once this extension is complete, the inertia of the advancing mass will cause the entire dart to jump forward, capable of then traveling at between 80 and 100 miles per hour or more. Imagine a coil spring being compressed and then released quickly. It too will jump as a result of its extension.

PART III OF THIS ARTICLE WILL BE PUBLISHED IN THE NEXT ISSUE OF "THE ATLATL." NOTE: New members wishing to purchase the Summer 1989 issue of "The Atlatl," with Part I of this three part paper may order it by paying $4.00 while supplies last.

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HE WHO LAUGHS WHEN THINGS GO WRONG HAS JUST THOUGHT OF SOMEONE HE COULD BLAME IT ON.

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In the "is my face red" department, Your editor noted too late for correction in the last issue of THE ATLATL that one of our most famous members was omitted from the list of Board of Directors of the World Atlatl Association--BONEY COSYLEON. Sorry about that.

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THE ATLATL WORLD OPEN RESULTS

BY
RICHARD L. YOUNG
MUSEUM DIRETCTOR
FORT CASPAR MUSEUM
CASPER, WYOMING

The Atlatl World Open was held Saturday, August 19, 1989. Winners were as follows:

CHAMPIONSHIP ROUND:
1. **BRIAN JAMES**
2. **PAUL LEININGER**
3. **CHARMON HELMICK**

MEN'S DIVISION
1. **PAUL LEININGER**
2. **BRIAN JAMES**
3. **TROY HELMICK**

WOMEN'S DIVISION
1. **CHARMON HELMICK**
2. **ELIZABETH ENGLISH**
3. **LENI CLUBB**

JUNION DIVISION
1. **BILLY WEBB**
2. **CODY GOOD**
3. **KEVIN ARBOGAST**

TEAM DIVISION
1. **BRIAN JAMES & BOB PERKINS**
2. **PAUL LEININGER & CHARMON HELMICK**
3. **GEORGE STEWART & DAVE NASH**

CHARTER MEMBERS OF THE WORLD ATLATL ASSOCIATION

J. KEITH ABERNATHY
RICHARD BAUGH
JERRY BEAL
MELVIN K. BEATTIE
DENNIS BELCHER
CHARLOTTE BECHTOLD
TIMOTHY J. BOUCHER
DOUGLAS W. BOWMAN
BPS ENGINEERING
FRANK BURKE
MIKE BURKE
JOHN BURTON
ISABELLE CHAMPLAIN
MARK CHRISTENSEN
KEIGH CLINGSMITH
LEONORE B. CLUBB
BONIFACIO COSYLEON
JEANNE CROUCH
HEIDI DAETWYLER
VINCENT DORIA
MICHAEL EARNST
MICHAEL ELDREDGE
KAY EVATZ
DONALD B. FISHER
EARL FISHER
FORT CASPAR MUSEUM
GARY L. FOGELMAN
LEWIS D. FUNK
KENNETH A. GRAMSTAD
JOSEPH GRGURICH
LINDA W. GROTH
IVOL K. HAGAR
TROY C. HELMICK
LESLIE C. HERMAN
ADA BOURIL JACKSON
BRIAN JAMES
SHEILA JAMES
AUGUST JANSSEN
MARILYN JESMIN
LEE JOHNSON
L.CHRISTINE JUDSON
JEAN KINDIG
MARY M. KISER
DORIS KUCINSKI
LEON B. LACY
RODERICK D. LAIRD
TIMOTHY J. LEPORE
ADRIAN S. LEMOS
SCOTT W. LESLIE
CHARLES R. LILLY
SCOTT MADDEN
WILLIAM MAXSON
JAKE MCGAVOCK
THOMAS D. MOORE
TERRENCE MURPHY
CARL G. NELSON
MARY NELSON
ELIZABETH OLINGER
HAROLD PATE
RAYMOND G. RIESER
DAN RYAN
MICHAEL RYAN
MARTIN STEIN
R. L. SIMONSON
BARBARA M. SNOBBLE
SUE STRUTHERS
FREDERICK SUROWIEC
WILLIAM H. TATE
WILLIAM H. TONKS
STEVEN WATTS
TERESA J. WEEDIN
DAVID L. WESCOTT
MANUEL WHITE
LESLIE E. WILDESEN
GARY ZEH

The above 75 members are reported by WAA Secretary, Charlie Lilly, as being "Charter Members" of the organization. They hold this distinction by having been members during the first year of its existance, 1988-89.

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Your editor recently came back from a twenty-two day visit to Europe. One of the highlights from this memmory filled trip was viewing two beautifuly carved antler atlatl fragments in a case in the Musee de l' Homme, (Museum of Man) in Paris. We were struck by the delicacy of the fragments--maybe that is why there were only fragments remaining.

Bob Perkins and Paul Leininger recently spent several days in the back rooms of the Smithsnoian Institution examining atlatls and related materials. We hope there will be a report for a future issue of this newsletter.

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YOUR INPUT

We would like to gather all significant information about the atlatl for our newsletter. Please send your notes, locations of events, stories, clippings, reports etc. which relate to the atlatl to WAA, The Atlatl, 1191 Nucla Street, Aurora, CO 80011.

Other WAA correspondance should be addressed to Mr. Charley Lilly, Secretary, 8800 State Highway 133, Carbondale, CO 81623.

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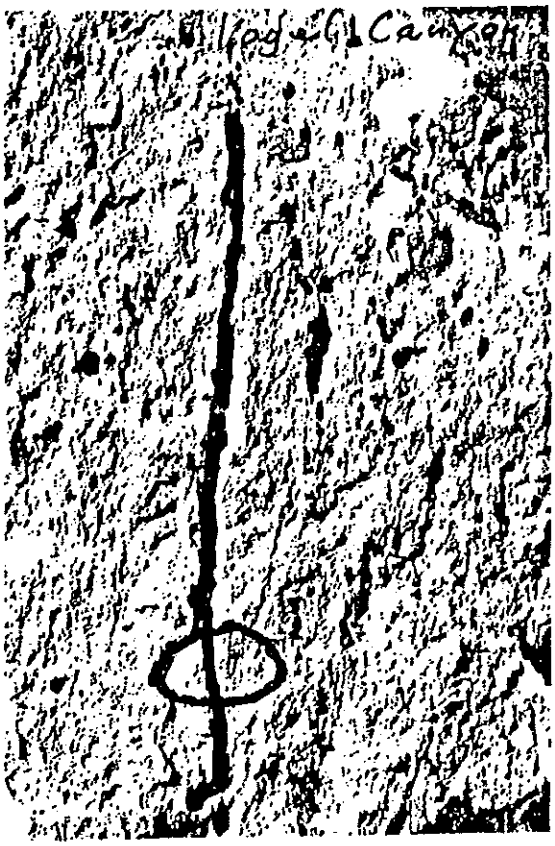
MORE MUSEUMS WITH ATLATL DISPLAYS:

By Chris Judson

Geronimo Springs Museum
Truth or Consequences, NM
(Slender, elegant atlatl, labeled 7000 BC)

Natural History Museum
Golden Gate Park
San Francisco, Calif.
(Australian woomera on display)

Bandelier National Monument
Los Alamos, New Mexico
(demonstrations using replicas)



THE ABOVE ROCK ART ATLATL CAN BE FOUND IN VOGEL CANYON, OTERO COUNTY, COLORADO. PHOTO BY: ROD BARTLETT

GREETINGS FROM YOUR NEW PRESIDENT

I am happy to have the opportunity to serve as President of the WORLD ATLATL ASSOCIATION.

Those of you who know me, know that atlatl making and throwing... as well as encouraging others to take up the sport, continues to be my greatest pleasure. It all started in July 1983 when I went to Saratoga, Wyoming with my crudely-made atlatl and spear, to enter the Atlatl World Open for the first time. I was to be the first woman to enter this annual contest. At home, in Colorado, I had no one to show me how to stand, or how to throw correctly. My first real practice came when I arrived at the contest field. Needless to say, I did poorly. But, the men didn't laugh when it took me five throws to even reach the 100 meter target ...and then miss it!!

After that exciting contest, I went home determined to introduce the great art of throwing to my Colorado Archaeological Society Chapter, and to all the other chapters as well. Within a year, after those of us in the "Lyons Chapter" who had made our own Atlatls and spears attended general meetings of the Society and demonstrated the sport. Now almost every chapter has throwers of all ages. In 1985, the First Encampment of the Colorado Archaeological Society took place on July 4th at Twin Lakes. It featured an atlatl contest and Indian games and was a huge success. Its fifth anniversary is to be held, again at Twin Lakes, CO (near Leadville) on June 30, 1990.

The World Atlatl Association, the "brain child" of Charley Lilly with Bill Tate and Doug Bowman, was organized and incorporated in the State of Colorado in September 1987, and by July 4th 1989 had 75 Charter Members. The October 1, 1989 membership report shows forty-eight members, either new or renewed, with twenty-eight of those from outside of Colorado. We have members from Idaho, California, New Mexico, Ohio, Montana, North Dakota, Florida, Washington, North Carolina, Maine, Pennsylvania, Michigan, Rhode Island, Nebraska, and Kansas, as well as Colorado. Maybe that's not the "World" yet, but we will grow.

I have been in Contact with the Nevada "Valley of Fire" park ranger in regard to organizing a contest near Las Vegas so perhaps we will add Nevada to our list of states.

I hope that many of you will participate in 1990 in the various contests held in Colorado, Montana, Wyoming, Idaho and Pennsylvania, thus fulfilling paragraphs A. and B. of our WAA constitution, Article 3: A. the purpose of this Association shall be to encourage the manufacture, use, practice, promotion and perpetuation of the Atlatl....and B. to bring together those persons interested in the atlatl.

LENI CLUB, President

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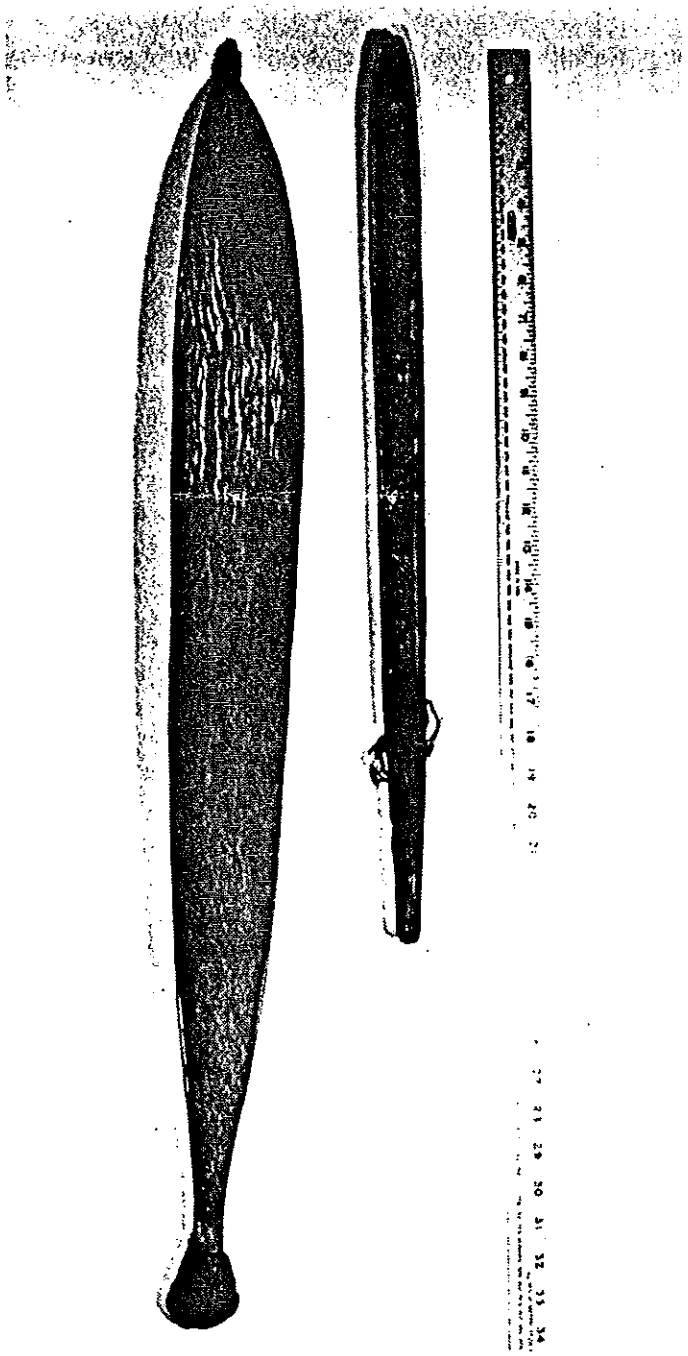

The Australian atlatl or to use their term, "Woomera" on the left was brought back from Aurtralia by President Leni Clubb at the request of your Editor, and its present owner, Bill Tate. It is beautifully made, and as can be seen, is nearly 34 inches in length.

The similarly shaped, but much more crudely made item on the right, was sent to us for evaluation from Jay Crotty of Sandia Park, New Mexico. It too, comes from Australia. Some ten inches shorter, than the authenticated woomera, this object was described to us as a possible tourist item. The piece shows some wear, and although not ancient, does show age. As crude as the workmanship is and based on its small size, it is our opinion that this is a childs toy, rather than an item for the tourist trade.

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10% DISCOUNT

WAA members receive a 10% discount on their purchases from the following firms manufacturing atlatls and related equipment:

BPS Engineering, Box 797, Manhattan, Montana 59741
phone, (406) 284-3307
BPS Engineering is the maker of the "Mammoth Hunter", Warrior" and other fine atlatls and darts. Call or write for more information.

Tate Enterprises Unlimited, Inc., P. O. Box 110755, Aurora, Colorado, 80042-0755
Phone, (303) 364-0059
Contact Tate Enterprises for information on their "Spearchucker" kits, readymade equipment, and instructional material.

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WHAT EVER HAPPENS,
LOOK AS IF IT WAS INTENDED

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