Introduction

Since the middle of the 20th century, North American archaeologists have speculated about the function of ‘beveling’ or ‘rifling’ along the blades of prehistoric projectile points (Campbell and Ellis 1952: 217). These bevels result from steep flaking on alternate faces of a pointed blade. Most archaeologists assume that beveling is the result of reshaping in which broken bifaces are “rejuvenated” by steep flaking to create sharp edges with a relatively shorter blade length (Smith 1953). This explanation, however, does not account for the fact that beveling appears to be relatively common in the middle archaic (e.g., 8-6000 BC) in North America and reduces in frequency later in prehistory.

Here, we postulate that beveling of the blade edges of bifaces provides key features to its ballistic properties. As the result of differential pressures on alternate sides of a biface, we expect that beveling will cause bifaces to rotate at certain velocities. If beveling causes projectiles to spin, this would provide angular momentum that would decrease variance from the initial path, thus allowing spear shafts to fly with better accuracy over greater distances.

This goal of this study was to test the hypothesis: Does beveling on bifaces produce rotation?

Expectations

Bevel projectile points appear asymmetrical on opposing sides of the blade, so after measuring we hypothesized that a range of angles would be present.

• This would affect the lift of the points, as “the asymmetrical flow of air around the surface of an asymmetrical projectile serves to increase flight distance” (Hughes 1998: 349).
• The mean of the angle of the bevel on all six measured projectile points equaled 45 degrees, so we hypothesized that the manufactured projectile point with a 45 degree bevel would spin at the lowest wind velocity.
• The manufactured projectile points with a ‘twisted’ or asymmetrical bevel would spin better than the manufactured projectile point with a full 45 degree bevel, as we hypothesized that asymmetry would affect the spin of the points.
• As the beveled projectile points in this study occur at a time in prehistory when technology was changing from spear-throwing to spear-throwing, we hypothesized that the point would spin at a velocity equivalent to a throwing spear.
• The beveled projectile points were expected to spin at 18 mps (Hughes 1998).

Methods

We analyzed six beveled projectile points from archaeological collections at California State University Long Beach.

• We conducted a series of measurements on each of the 9 projectile points along attributes such as blade length, blade width, maximum thickness, and overall length.
• We measured blade angles along the horizontal and vertical axes across 10 locations for each point (in order to characterize overall angle of the bevels). (Figures 1-3).
• We also manufactured free projectile points out of plexi-glass and tested them in the low speed wind tunnel at CSULB. The angle of beveling varied across each point but included:
  • 45 degree full bevel
  • 65 degree full bevel
  • 60 degree twisted bevel
  • 57 degree twisted bevel
  • 50 degree full bevel
  • 20 degree twisted bevel
• We tested both manufactured and actual projectile points in the engineering department at CSULB where measurements such as initial rotation, torque, and wind velocity were calculated and recorded (Figures 5-10).

Results

• Measurements taken on archaeological projectile points show that the angle of beveling is not uniform, instead they appear intentionally asymmetrical along the blade, with the mean angle falling at approximately 45 degrees.
• The beveled projectile points, whether of a functional and manufactured, began spinning at approximately 18mps and ceased spinning at 22mps (Chart 1).
• The 65 degree full bevel and twisted bevel each spun at higher speeds, while the 45 degree full bevel and 57 degree twisted bevel each spun at lower speeds.
• While both full and twisted beveled points spin in the wind tunnel, those points with an asymmetrical (‘twisted’) design spun at lower mps than did the beveled projectile points (Chart 1).
• This is further evidence that the asymmetrical design was intentional and served a functional purpose.

Discussion and Conclusions

Hughes (1998: 397) states that “throwing spears are less advantageous in use situations [than the bow and arrow] because they are characterized by shorter effective distances, require an upright stance, require motion to throw, and are slow in repeating shots.” Because beveled projectile points existed at a time when spear-throwing was the predominant form of weaponry, we hypothesized that beveling was a functional trait that developed to help increase the distance a spear was able to travel. By creating spin, beveled projectile points would help keep the projectile tangent to the flight path.

When tested in the wind tunnel, all beveled points spun between 18 and 25 mps, which supports the hypothesis that they were related to spear-throwing technology. An angle of 45 degrees was more than just intentional reshaping. Torque measurements provide further evidence for this, as displacement terminates by 25 mps. From our initial results, we further hypothesize that beveled projectile points occur at a specific period of time, namely as projectile point technology shifted from spear-throwing to spear-throwing. As Hughes (1998: 397) points out, “prehistoric weapons were precision instruments. Years of experimentation, meticulous craftsmanship, and skill went into their design and manufacture to create the most efficient killing machine for that technology.” The beveling of certain projectile points further demonstrates this fact, as it shows the creation and implementation of a functional trait that increased the effectiveness of spear-throwers as prehistoric weapons.

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References:


Beveled Projectile Points and Ballistics Technology

Veronica Harper, Azzurra Di Marcello, and Jessica Jaynes

California State University, Long Beach

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