INTRODUCTION

Neo-Inuit cultures of the 1st and 2nd millennium AD used and propagated the technology of the “free-backing bow” on the entire Alaskan coastline until guns were introduced ca. 1870’s:

- A reinforcement of sinew cables tied on the back of the bow and the use of siyah* on curved limbs (fig.1) were key technological innovations in the archers’ ability to use powerful bows while making the best use of the limited materials available in the arctic environment.

- Variabilities in the technology have been analyzed according to regional and chronological types1-2, most often by looking independently at the bow and/or arrow.

The bow and the arrow (B&A) depend on each other and work jointly to fit the archer’s needs and abilities, by forming one technical and mechanical system.

RESEARCH GOALS

- Demonstrate the utility of developing an analytical protocol that combines typology, technology, mechanics and ballistic of the study of the bow and the arrow conjoinly to understand both items as part of possible systems fitted to the archers and their activities (hunting or wage war).

- Identify and discuss the technical and mechanical choices involved when archers create system(s) that meets their needs.

MATERIAL & METHODS

(1) Morphological and dimensional recordings:

Fig.3 and 4 show the multiple characteristics and measurements systematically recorded on key elements of the bow and the arrow.

(2) Calculations of mechanical properties

- In archery, the arrow spine (fig.5) is a fundamental mechanical element that measure arrow’s flex during the exercise of a force applied in its middle. It represents the rigidity of the shaft and its capability to bent during the release of the cord. The more rigid an arrow, the more it need to be shot with a powerful bow, and vice versa. This will match the arrow to the bow’s proper draw weight (in lbs 4) of the bow helps prevent fractures of either, improve accuracy, and limits the effect of the archer’s paradox*.

Preliminary Results

(1) Arrows showed a variability in dimensions, but we noticed a correspondence between length and diameter of the shaft. It is a sign that archers selected arrows same matching their bow and draw length.

(2) The simulated mechanical performances of the four modeled ethnographic bows are high and show strong draw weights (ca. 608 to 1109) point to their use by adults with relatively good shooting skills.

(3) Only four of the 18 analyzed arrows share appropriate length and spine to be shot with the analyzed bows. Another smaller arrows have spine suited for being drawn by small but strong bow. The remaining arrows have yet to be related to specific bows.

DEFINITIONS & REFERENCES

Siyah: rigid and curved and forming a “bow” on the limbs. This technology is originated from Asia in Scythia, Chinese and Korean bows.

The bow’s paradox: During release, arrow flexes and “waves” around the handle instead of following a straight line inside its trajectory.

Stacking: increase in draw weight happening when drawing bow past its optimal draw length. It becomes unexpectedly harder to draw the bowing.

3D modeling and simulation are useful for assessing the performance of fragile bows and arrows from Museum collections.

However, our preliminary results have yet to take into account the varying elasticity and strength of the sinew cables in relation to whether (and how) it was twisted (or not). Indeed, Inupiaq archers adjusted curved cables to conditions of use (humidity, temperature, individual strength...) by twisting or untwisting the cables which most likely had an effect on the power of the bow. Similar questions arise for the bowing. Thus, these mathematical simulations should not prevent us from considering how Inupiaq archers chose the settings of their bows and arrows. Our preliminary analysis show these settings to be highly precise, which is based on Inupiaq empirical knowledge and experience.

Future experimental and practical shootings will test these questions.

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References:


