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Throwing Light on the Past

A New Methodology for Analysing Activity-related Skeletal Changes in Humeri

Liagre Elle^a, Knüsel Christopher J.^a, and Villotte Sébastien^{b, c, d}

The **medial epicondyle of the humerus** is a particularly relevant anatomical area to reveal **physical activities** performed during an individual's lifetime ¹⁻³ (e.g. throwing of objects, the use of axes and stone tool manufacture)^{4,5} and the **sexual division of labour** in past human groups. However, the qualitative recording of osseous alterations in this area remains particularly subjective and prevents large-scale comparisons.

The **main aim** of this research is to develop a novel method to record these alterations quantitatively through non-invasive 3D-imaging.



Collection

Collection of data

- **Prerequisite:** 3D model of humerus
- Can be obtained through CT-scanning, 3D surface scanning, or photogrammetry

Preparation

Pre-processing of models

- Crop
- Orientate
- Filter (i.e. simplification, smoothing)

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Quantitative Analysis

What? Topographical analyses

- quantify the whole-surface morphology,
- through complementary variables such as curvature, relief and complexity

How? molaR package⁶ in an R environment

Which analyses?

- **Dirichlet Normal Energy (DNE)** (curvature measure that quantifies the degree of surface bending)
- **Relief Index (RFI)** (relief measure calculated through the ratio of the 3D surface area to the 2D footprint)
- **Orientation Patch Count (OPC)** (complexity measure that counts the number of similarly oriented regions)



Conclusions & Prospects

- **Complementary shape variables** can be applied to quantify osseous alterations of the humeral medial epicondyle.
- Through **3D-imaging**, the method offers a **non-invasive** approach to more **objective** recording of these alterations.
- Application to **identified osteological** collections will improve understanding of the analyses' results and their interpretation.
- The method can **create new insights into physical activity and sexual division of labour in the past.**

References

1. Dutour O, 1992. Activités physiques et squelette humain : le difficile passage de l'actuel au fossile. *bmsap* 4, 233–241. | 2. Dutour O, 2000. Chasse et activités physiques dans la Préhistoire : les marqueurs osseux d'activités chez l'homme fossile. *Anthropologie et Préhistoire* 111, 156–165. | 3. Villotte S, Churchill SE, Dutour OJ, Henry-Gambier D, 2010. Subsistence activities and the sexual division of labor in the European Upper Paleolithic and Mesolithic: Evidence from upper limb enthesopathies. *JHE* 59, 35–43. | 4. Knüsel CJ, 1992. The throwing hypothesis and hominid origins. *Hum. Evol.* 7, 1–7. | 5. Villotte S, Knüsel, CJ, 2014. "I sing of arms and of a man...": medial epicondylitis and the sexual division of labour in prehistoric Europe. *J. Archaeol. Sci.* 43, 168–174. | 6. Pampush JD, Winchester JM, Morse PE, Vining AQ, Boyer DM, Kay RF, 2016. Introducing molaR: a New R Package for Quantitative Topographic Analysis of Teeth (and Other Topographic Surfaces). *J Mammal Evol* 23, 397–412.