Biological Profiles: An analysis on the applicability and implications of traditional and new methods in forensic anthropology

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WHAT IS A BIOLOGICAL PROFILE?

- Detailed report of **identifying characteristics or biological information** of an individual.
- Typically comprised of **four key components of estimation:**
  - Age
  - Sex
  - Ancestry
  - Stature
- Can be further refined!
  - Skeletal variation
  - Pathology
  - Trauma
- **Why does this matter?**
  - Identification
  - Further research
  - Medico-legal importance

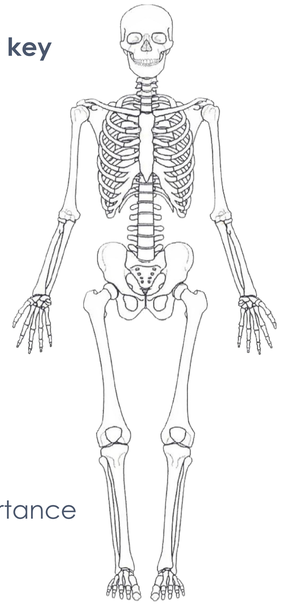

Figure 1. Human skeleton in anatomical position.

AGE ESTIMATION

TRADITIONAL METHODS

- **Dental development (crown & root)**
- **Pubic symphysis** – Figure 2
- Auricular surface
- Cranial suture closure
- Epiphyseal growth
- Sternal rib ends

IMPLICATIONS

- Reliability & variation
- Improper selection/use of methods
- Limitation of knowledge

ADVANCES IN METHODS

- **Multifactorial age estimation**
  - **Transition analysis**
- Radiologically-based methods
- Biochemical analysis
- Radiocarbon dating
- Histological methods

IMPLICATIONS

- Invasive & destructive
- Ethical standards
- Unvalidated methods/reference population

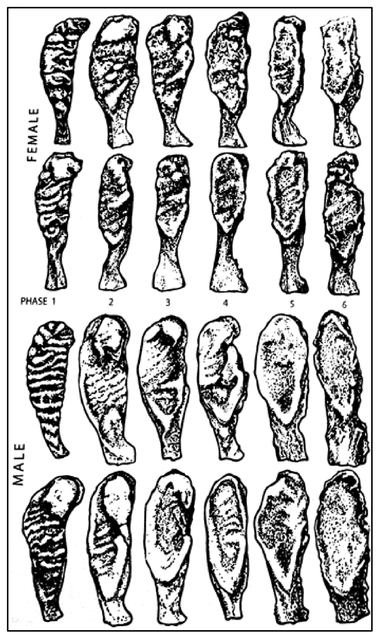

Figure 2. Pubic Symphysis scoring (Buikstra et al., 1994).

SEX ESTIMATION

TRADITIONAL METHODS

- Sexual dimorphism → morphological differences & hominin evolution
- **Pelvis (Non-metric)** – Figure 3
  - **Ventral arc**
  - **Subpubic concavity**
  - **Ischio-pubic ramus (medial aspect)**
  - Pubic shape & subpubic angle
  - Greater sciatic notch
- Skull (NM)
  - Nuchal crest
  - Mastoid process
  - Supraorbital margin & glabella
  - Mental eminence
- **Postcranial long bone dimensions (Metric)**

IMPLICATIONS

- Sex vs gender
  - Limited research on trans individuals
- Subadults & variation

ADVANCES IN METHODS

- Molecular methods (DNA)
- Postcranial bones

IMPLICATIONS

- Accuracy & reliability
- Accessibility

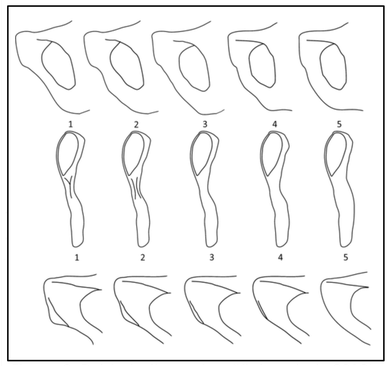

Figure 3. Pubic traits scoring (Klales et al., 2012).

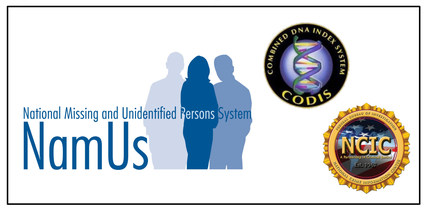

Figure 7. Existing databases.

ANCESTRY ESTIMATION

TRADITIONAL METHODS

- **Morphoscopic (NM)** – Figure 4
  - Optimized Summed Scored Attributes (OSSA) (Hefner & Ousley, 2014)
    - Macromorphoscopics program
  - Decision Tree Modeling (Hefner & Ousley, 2014)
- **Craniometric**
  - FORDISC (Jantz & Ousely, 2005)
- Dental metrics
- Postcranial methods
- Genetic information

IMPLICATIONS

- Variation & ambiguity
- Underdevelopment (subadult)
- Marginalization/oppression of groups
- Historical background
- Lack of [reference] population data

ADVANCES IN METHODS

- Human Mandible Identification – (hu)MANid (Berg & Kenyhercz, 2017)
- Diversification of population data

IMPLICATIONS

- Reliability with newer research
- Ethical standards

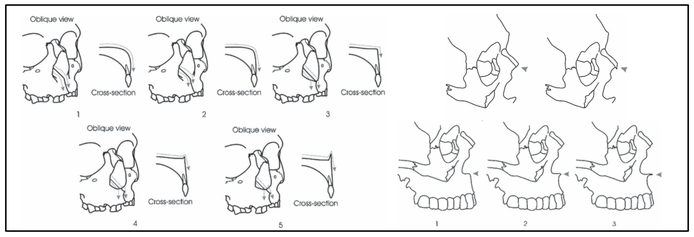

Figure 4. Morphoscopic traits scoring (Hefner, 2009).

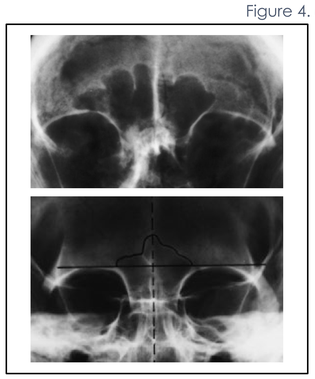

Figure 6. Frontal sinuses (Caplan, 2019 & Besana, 2010).

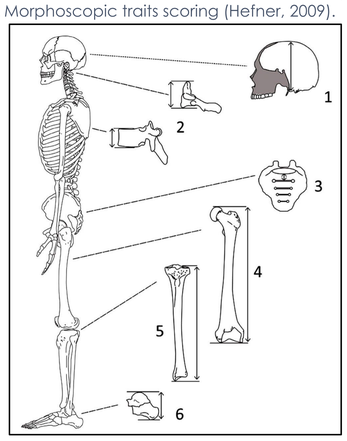

Figure 5. Measurements in anatomical method (Willey, 2009).

STATURE ESTIMATION

TRADITIONAL METHODS

- Anatomical method – Figure 5
  - Cranial height
  - Vertebrae (C1, C3-7, T, L, S1)
  - Femur & tibia length
  - Talus-calcaneus height
- Linear regression method
  - Mathematical relationship of postcranial long bones
- FORDISC (Jantz & Ousely, 2005)

IMPLICATIONS

- Requirement of mostly complete skeleton
- Higher error/low precision - limited remains

ADVANCES IN METHODS

- Subadult stature
- Advanced age

IMPLICATIONS

- Limited research & unreliable
- Antemortem & known stature
- Pathologies/anomalies

FURTHER ADVANCEMENTS

- Methods
  - Frontal sinus identification – Figure 6
  - Databases – Figure 7
  - Stable isotope analysis
- Need for intersectionality & diversity
  - Equity matrix - osteology + intersectionality (Rosen, 2023)
  - Diversify population data
- Estimations → approximations of reality
  - Selection of methods/reference samples are key

ACKNOWLEDGEMENTS

Special thanks to the **Cal Poly Humboldt Department of Anthropology**, especially Dr. Marissa Ramsier and Dr. Mary Glenn, for supporting my academic interests and future aspirations. Please use this **QR Code** to access all the **references**, including the literature that was analyzed for this poster.

REFERENCES