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Introduction

Hetep-Bastet is an Egyptian mummy housed in the Galerie de l' Université du Québec à Montréal. She dates to approximately 600BC and is associated with an elaborate wooden coffin. Preliminary analysis based on CT scans and presented in Nelson et al. (2009), showed that she was an elderly female who stood approximately 157.5cm tall, suffered from severe dental degeneration and from atherosclerosis. She had been eviscerated, but damage to the mummy prevents an accurate determination of the exact details of organ removal. Her brain had been removed through her foramen magnum.

The objective of this work was to segment a digital model of her skull from the CT scans, to create a rapid prototype model and then to reconstruct her face in order to "bring this woman back to life". In particular, we sought to develop a technique allowing this individual to be depicted at two different ages - her age at the time of death, and as a younger woman. This process has important implications for museological presentations as well as for modern forensic cases.



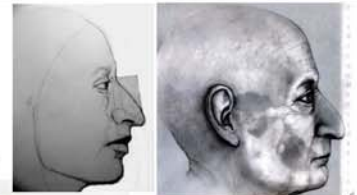
Model Segmentation

Segmentation of Hetep-Bastet's skull was extremely challenging, as a large quantity of resin had been poured over her face as she was wrapped. The resin proved to be extremely difficult to separate from the bones of her face, as they both had very similar density characteristics. However, we were able to achieve separation by using two scans taken at different x-ray energies and then creating a new image using post-processing techniques (Friedman et al, in press, Granton et al, 2008). This process is possible because the bone and resin react slightly differently to the x-ray energy at the two energy levels. The new image contained mostly pixels identified as bone, and the 3D model was created using the software package called Amira.

Hetep Rough Segmentation

2d Facial Reconstruction

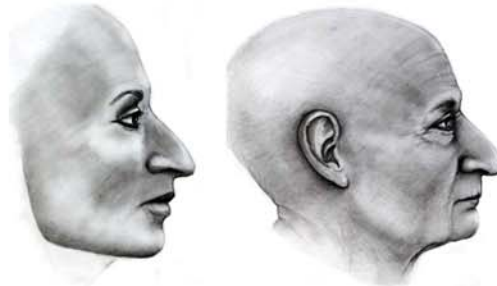
Both 2d facial reconstructions were completed using the modern standard method. (Taylor, K. 2001)
Placement of tissue depth markers and Egyptian measurements by El-Mehallawi, IH; Soliman, EM, (2001)
Prediction of young and old nasal morphology from the skull was measured and drawn according to Rynn, C., Wilkinson, C., Peters, H., (2009). Nasal cartilage in Old Hetep is shown to droop incorporating the aging factor. (Taylor, K. 2001).



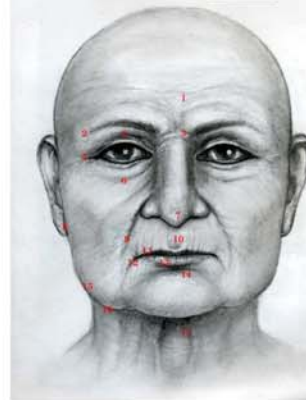
Young and old nasal morphology



Reabsorbed bone, and missing teeth were replaced with clay to simulate the full form of a youthful appearance.



Hetep age 60 +



Signs of Age 1. Transverse frontal lines; 2. Eyebrows have dropped; 3. Transverse nasal lines have developed; 4. Excess skin obscures superior orbital groove; 5. Lateral orbital lines; 6. Inferior orbital groove develops into bags; 7. Nasal cartilage droops; 8. Ears appear larger; 9. Nasolabial furrows deepened; 10. Philtrum deepened; 11. Circumoral Striae cross the vermilion border of the lips; 12. Ormental groove deepened; 13. Lips thinned; 14. Mentolabial fold deepened; 15. Softened jaw line; 16. Jowls; 17. Neck lines and sagging tissue under the chin. (From Taylor, 2001).

3d Facial Reconstruction

Wigs: Tripartite and curled wigs, contemporary styles during the 26th Dynasty are fashioned after Saite woman's coffin and Isimkheb wig. (Fletcher, J., 2002)

Eyes: Human prosthetic eyes were used. To show the aging factor, Old Hetep's eyes have arcus and additional veining. (Kazanovitz, PJ 2010)



Photo of Isimkheb wig courtesy of Dr. J. Fletcher



In the final 3d facial reconstructions, old Hetep is depicted as a 26th Dynasty, female Egyptian, approximately 60+ years of age wearing an Isimkheb style wig as it would have looked during her lifetime. Young Hetep is shown as a 26th Dynasty, female Egyptian, approximately 30yrs of age wearing a tripartite wig.

Age regression is an important technique for the forensic artist who is seeking to match a skull to a photograph of a potential victim taken at a much younger age. This is the first time that the technique has been applied to an Egyptian mummy. This technique has important applications in Egypt and other early civilizations where identified artistic representations exist that could be matched with unidentified skeletal or mummified remains.



Photo of Tripartite wig Saite Coffin courtesy of Dr. J. Fletcher

Citation

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