

From skull to brain

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▶ To cite this version:

Edwin de Jager, Laurent Risser, Muriel Mescam, Caroline Fonta, Amélie Beaudet. From skull to brain. FENS, Jul 2022, Paris, France. hal-03726337

HAL Id: hal-03726337 https://hal.science/hal-03726337v1

Submitted on 18 Jul 2022

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From skull to brain: 3D density maps of cortical sulci as a powerful tool for paleoneurology

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Key questions in palaeoscience concern the timing and mode of the bony brain case, constitute a proxy for reconstructing a timeline and process of cerebral changes within the human lineage (Holloway et al., 2004). Accurate identification of sulcal imprints in endocasts is critical for evaluating the topographic extension of these imprints in endocasts is critical for evaluating the topographic extension of these imprints in endocasts is critical for evaluating the topographic extension of these imprints in endocasts is critical for evaluating the topographic extension of these imprints in endocasts is critical for evaluating the topographic extension of these imprints in endocasts is critical for evaluating the topographic extension of these imprints in endocasts is critical for evaluating the topographic extension of these imprints in endocasts is critical for evaluating the topographic extension of these imprints in endocasts is critical for evaluating the topographic extension of these imprints in endocasts is critical for evaluating the topographic extension of these imprints in endocasts and the distortion of these imprints in endocasts is critical for evaluating the topographic extension of these imprints in endocasts is critical for evaluating the topographic extension of these imprints in endocasts is critical for evaluating the topographic extension of the evaluating the topographic extension of topographic extension of topographic extension of topograph (caused by intra-cranial components) renders accurately identifying sulcal imprints a challenging techniques combined with established methods used in population-specific brain atlases offer new opportunities for tracking evolutionary changes in endocranial characteristics (Beaudet et al., 2016). We aim to provide a population-level reference from which to guide future analysis of fossil endocasts, with the vision of reducing bias in future sulcal imprint identification endeavours.

Materials and Methods



References: Alatorre Warren, J. L. et al. (2019) Proceedings of the National Academy of Sciences, 116(44), 22115–22121; Beaudet, A. et al. (2016) Journal of Human Evolution, 101, 65–78; Connolly, C. J. (1950) External Morphology of the Primate Brain; de Jager, E. J. et al. (2019) Journal of Anatomy, 235(4), 803–810; Fillard, P. et al. (2007) Neurolmage, 34(2), 639–650; Holloway, R. L. (1981) American Journal of Physical Anthropology, 56(1), 43–58; Holloway, R. L. et al. (2004) The Human Fossil Record; L'Abbé, E. N. et al. al. (2005) HOMO, 56(2), 197–205; Neubauer, S. (2014) Brain, Behavior and Evolution, 84(2), 117–134; Subsol, G. et al. (2010) American Journal of Physical Anthropology: 79th Annual Meeting of the American Association of Physical Anthropologists, 226–227; Yoshizawa, S. et al. (2007) 15th Pacific Conference on Computer Graphics and Applications (PG'07), 231–237.

Acknowledgements: This research has been funded by South Africa/France (PROTEA) Joint Research Programme (grant number 129923) as well as the University of Cambridge Harding Distinguished Postgraduate Scholars Programme. We thank the DST-NRF for sponsoring the Micro-XCT facility at Necsa. We thank G. Krüger for collection access; AN van Schoor for anatomical expertise; F. de Beer and L. Bam (Necsa) for data acquisition; J. Dumoncel (AMIS – UMR5288) for technical support. Ethical clearance was obtained from the Main Research Ethics committee of the Faculty of Health Science, University of Pretoria August 2017 (No:339/2017). Additional ethical clearance was obtained from the ethical committee at Cambridge.

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This approach provides an innovative, non-invasive, statistically modelled methrelating with observations from previous studies and literature (Connolly, 1950; tribute towards more refined endocranial research in paleoneurology. Expansion of our specimen database (i.e., primates and hominins) is expected to further improve the statistical power of observed features. This expansion will improve the detection of observable remodelling of these cortical features, and consequently contribute towards a completely observer independent approach; thereby guiding discussions surrounding fossil classifications and the contentious hypotheses on the evolution of cognitive abilities among hominins.



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Overlapping of imprints were observed A. when viewing imprints of the frontal lobe (A), as well as laterally (B) between the precentral, central and postcentral sulci with severe overlapping superiorly. Major overlapping was observed in sulci bordering the Broca's cap (C) and the sulci of the occipital lobe (D) involving the lunate sulcus.







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MEAN Anterior horizont Ascending rami $\overline{x} \leq$ st. dev. RIGHT LEFT Transverse occipital sulci RIGHT Lunate sulci Inferior temporal sulci Inferior occipital sulci D.