# A quantitative comparison of the brain and the inner surface of the cranium

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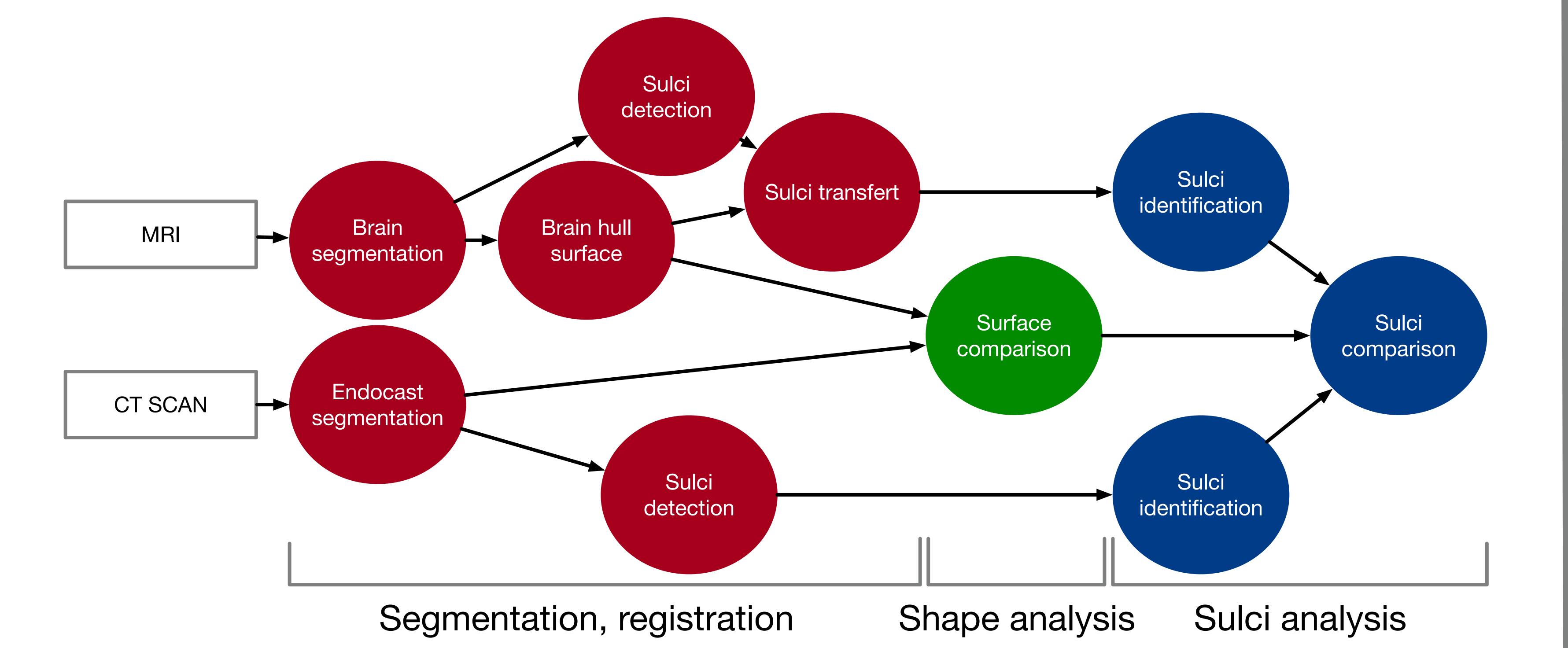
### Introduction

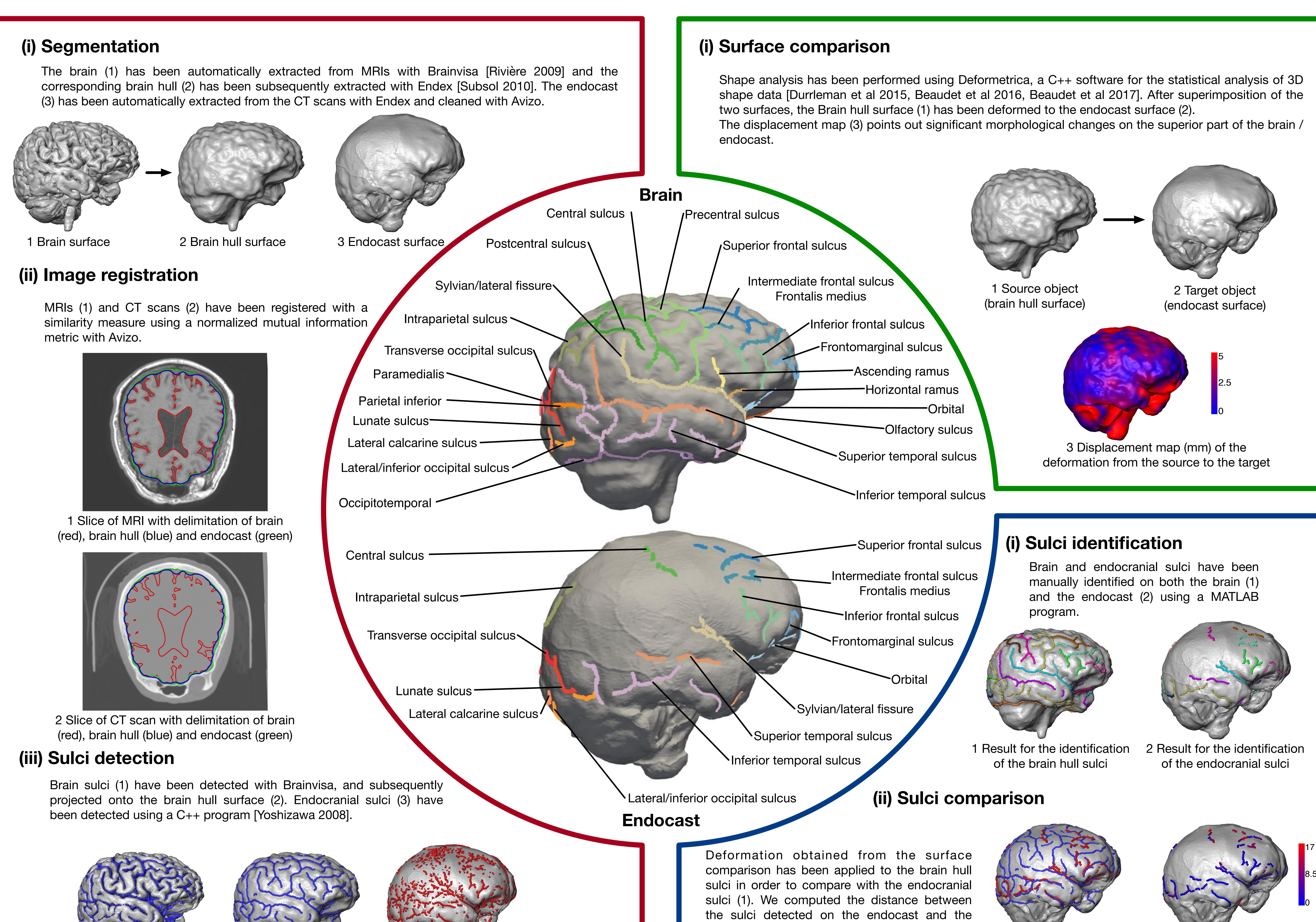
The correspondence of the brain and the endocranial shapes, as well as the coincidence of the gyral and sulcal pattern in the brain with the bulges and furrows imprinted on the braincase, have been the focus of historical debates [Boule 1917, Zollikofer 2000]. Because the brain rarely fossilizes, the endocast, i.e., a replica of the internal table of the bony braincase, is the only direct evidence of brain evolution in the human lineage. However, for now, only few publications have attempted to quantitatively compare the brain and the endocast [Fournier 2011]. In this study, we provide a morphological analysis of the brain and the corresponding endocast of the same individual by using different modalities (MRI and CT scan) and a combination of "state of the art" software coupled with custom-written program in MATLAB.

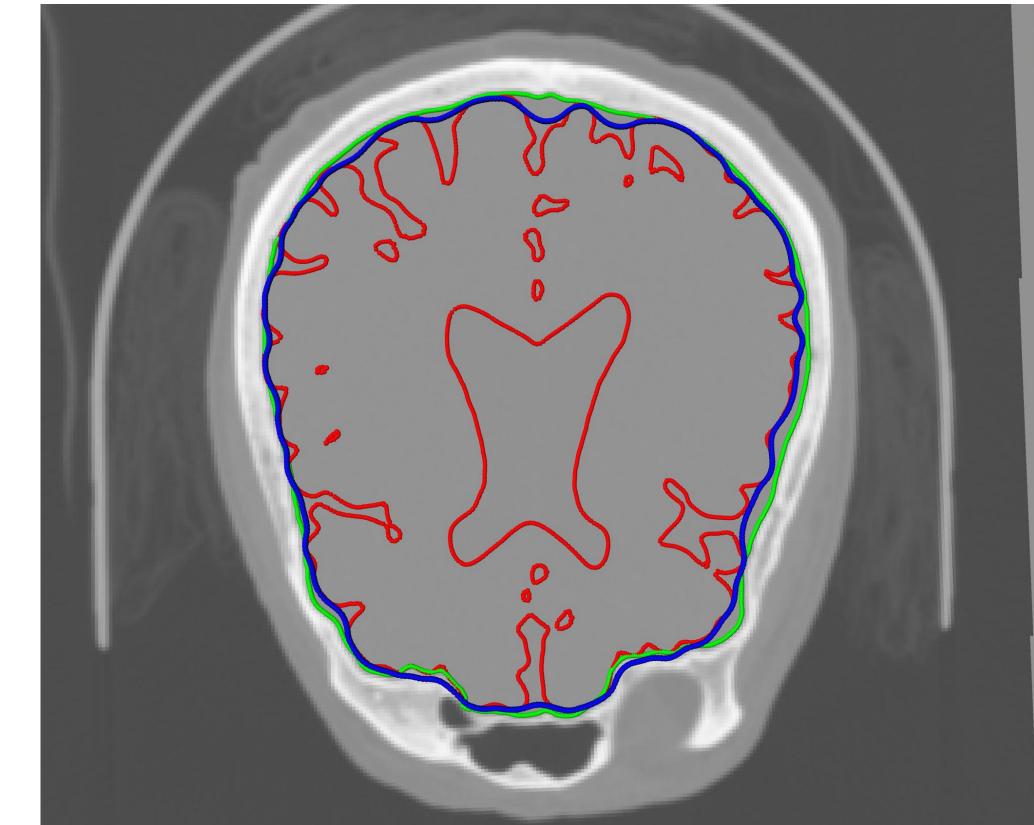


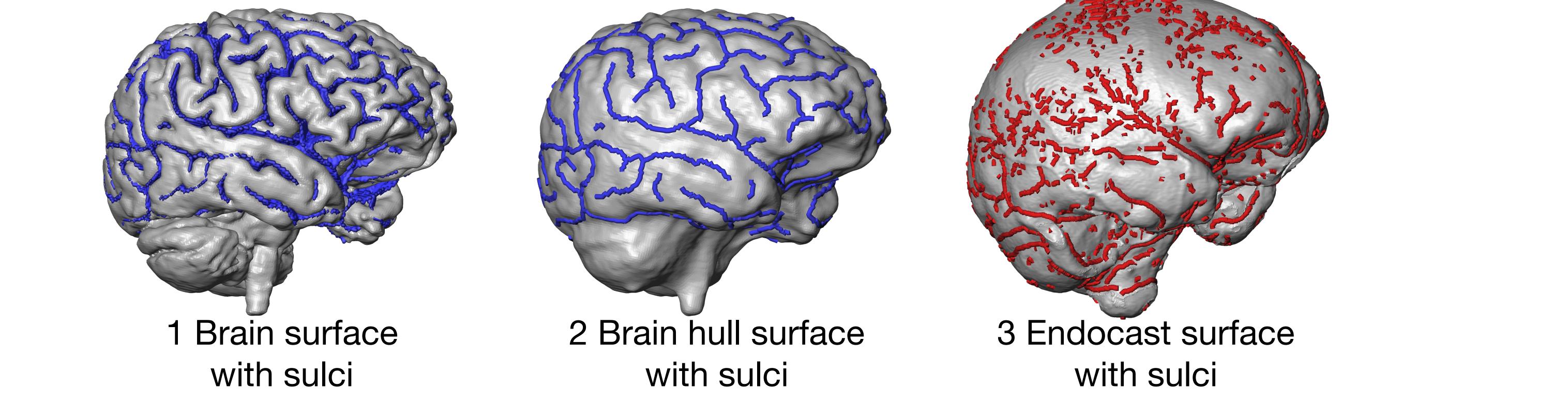
## Materials & Methods

We collected the MRIs and CT scans of a total of seven individuals from the clinical record of the Steve Biko Hospital in Pretoria (South Africa). Individuals suffering from cerebral pathologies or disorders affecting substantially the inner table were systematically excluded. Accordingly, we finally selected one individual.

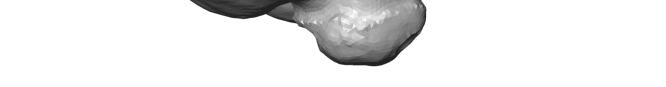


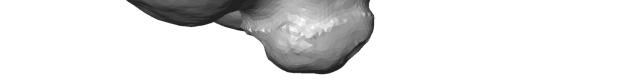






corresponding curves on the deformed brain hull (2). The best correspondances correspond 1 Brain hull sulci (red) after to the lateral aspects of the brain, where the deformation compared to brain is relatively close in terms of distance to the endocast sulci (blue) the inner surface of the cranium.





2 Distances (mm) from endocast sulci to the corresponding brain hull sulci

## Conclusion and perspectives

While our results suggest a close relationship between the sulcal pattern detected on the cerebral and endocranial surfaces, the correspondence in terms of morphology between the superior part of the brain and the endocast is more questionable. The lack of correspondance in this area might be due to potential geometrical distortions between CT scans and MRIs as well as differences in patient positioning during scans.

In this context, we plan to refine the deformation process between the endocast by testing different parameters, which may improve the quality of the registration. Moreover, we will include additional specimens to test our methodological approach. By providing a quantitative comparison of the brain and the endocast, our study constitutes a usefull reference for paleoneurological studies.

References: Beaudet A. et al. 2016. J. Hum. Evol. 101; Beaudet A. et al. 2017. J. Anat. 232; Boule M. et Anthony R. 1917. J. Anat. 51; Durrleman S. Et al. 2015. Neur. 101; Fournier M. et al. 2011. SPIE Med. Ima. 7962; Rivière D. et al. 2009. 15th HBM; Subsol G. Et al. 2010. Am. J. Phys. Anth. 141; Yoshizawa S. Et al. 2008. Comp. Aid. Geom. 25; Zollikofer C. P. E. Et al. 2000. Firenze University Press.

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