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Over the last 15 years computed tomography (CT) has become a common way to obtain high resolution three-dimensional images of cranial endocast of hominids. Among the different features that can be seen on such endocasts, of key interest are their shape asymmetries. In particular, protrusions of the frontal and occipital lobes, as well as differences in their width, have been typically observed in modern humans' brains. These have been often hypothesized to be linked to functional specialization, and especially language and handedness. The imprints of these protrusions on the inner surface of the skull are called the petalia. There is a lack of automated, reproducible and objective methods to quantify these protrusions and to assess (for instance) whether they are present in species other than *Homo sapiens*.

We propose a new method for the automated quantification of 3D endocranial shape asymmetries. We mathematically define the symmetry plane of the endocast as the 3D plane which best superposes the "right" and "left" sides of the endocranial surface. Then, we compute a 3D pointwise deformation field between the two sides of the endocast, allowing to match homologous points, and to assess their relative spatial position. The analysis of this 3D deformation field allows quantifying the shape asymmetries everywhere on the endocast.

We illustrate our method on the endocast of Sts 5 (Mrs. Ples, *Australopithecus africanus*) whose very high resolution CT scan has been segmented using ITK-SNAP. The results suggest an opposite shape asymmetry in the fronto-temporal and occipital regions.

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