



HAL
open science

3D automated quantification of asymmetries on fossil endocasts

Benoît Combès, José Braga, Francis Thackeray, Sylvain Prima

► **To cite this version:**

Benoît Combès, José Braga, Francis Thackeray, Sylvain Prima. 3D automated quantification of asymmetries on fossil endocasts. 79th Annual Meeting of the American Association of Physical Anthropologists (AAPA), Apr 2010, Albuquerque, United States. pp.83-84, 10.1002/ajpa.21276 . inserm-00592534

HAL Id: inserm-00592534

<https://inserm.hal.science/inserm-00592534>

Submitted on 12 May 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

3D automated quantification of asymmetries on fossil endocasts

BENOÎT COMBÈS^{1,2,3}, JOSÉ BRAGA⁴, FRANCIS THACKERAY⁵ and SYLVAIN PRIMA^{1,2,3}

¹INSERM, U746, F-35042 Rennes, France

²INRIA, VisAGeS Project-Team, F-35042 Rennes, France

³University of Rennes I, CNRS, UMR 6074, IRISA, F-35042 Rennes, France

⁴Lab. of Anthropobiology AMIS, University Paul Sabatier, Toulouse, France

⁵Institute for Human Evolution, University of the Witwatersrand, South Africa

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.

This abstract is part of the symposium entitled "Computational methods for the automated analysis of virtual hominid endocasts", organized by Sylvain Prima, Gérard Subsol and José Braga.

This research supported by the French Institute for Research in Computer Science and Control (INRIA). Grant: 3D-MORPHINE (Collaborative Research Initiative).