BISS Biodiversity Information Science and Standards

Biodiversity Information Science and Standards 3: e38778
doi: 10.3897/biss.3.38778

OPEN ACCESS

Conference Abstract

Speedy Palaeoanthropology: How virtual morphology, digital databases and open access policies boost research in human evolution

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Received: 02 Aug 2019 | Published: 08 Aug 2019

Citation: Bastir M (2019) Speedy Palaeoanthropology: How virtual morphology, digital databases and open access policies boost research in human evolution. Biodiversity Information Science and Standards 3: e38778. https://doi.org/10.3897/biss.3.38778

Abstract

The last two decades have seen the development of virtual morphology (ViMo), which emerged during the late 20th century through the application of medical imaging techniques to the study of fossil hominins (Spoor et al. 1994, Zollikofer et al. 1995, Conroy et al. 1998). The ViMo workflow has evolved successively by first building digital databases of fossil hominins, followed by digital reference collections, through the development of virtual 3D geometric morphometrics and, more recently, also 3D-printing (Fig. 1; Bastir et al. 2019). ViMo-workflows have led to a renaissance of morphological studies of diversity in evolutionary Earth and life sciences.

The aim of this presentation is to briefly present standard workflows in the Virtual Morphology Lab in the *Museo Nacional de Ciencias Naturales*, Madrid, and to show, more generally, how ViMo-technologies, together with paradigmatic changes in science (open access, digital data bases), contribute to boosting current research in human paleontology.

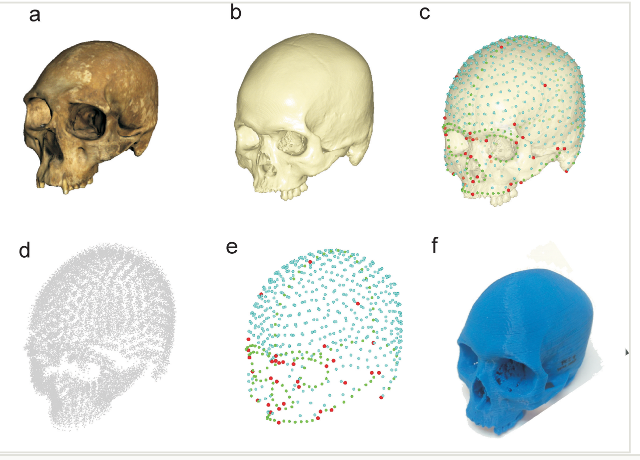

Figure 1.

A typical workflow in virtual morphology for geometric morphometric research in digital collections. a) original cranium; b) virtual 3D model of a cranium; c) virtual cranium plus 3D landmarks (3D point-, curve-, and surface measurements with Cartesian coordinates); d) superimposed 3D landmarks of a large sample of virtual 3D models of crania; e) 3D landmarks of the sample mean shape; f) 3D-print of a virtual cranium morphed to the mean shape.

The accidental discovery, in 2013, of fossil remains of a new human species, *Homo naledi,* in the Rising Star cave system, South Africa, has produced a large and important collection documenting early hominin diversity (Berger et al. 2015) . In the light of the huge amount of fossil material, a new research strategy was decided: different kinds of social media and an open-access policy were used for the organisation of a workshop focussed on the study of this new fossil collection and based on data sharing and global collaborations.

Because of this modern strategy, *H. naledi* was published very soon after its discovery (Berger et al. 2015) and simultaneously, the digitized fossils were made available to the public via MorphoSource, an open-access database. As a consequence, only five years later, more than 30 scientific publications have yielded almost 600 citations. This productivity is much higher than in any other recently discovered hominin species. Thus, 13 years after "glasnost" was proclaimed for paleoanthropology (Weber 2001), *H. naledi* has provided the first real example illustrating how open-access to digital collections accelerates and modifies research and diffusion in human paleontology.

Keywords

digital collections, open access, virtual museum, 3D geometric morphometrics

Presenting author

Markus Bastir

Presented at

Biodiversity_Next 2019

Acknowledgements

The author acknowledges Professors Peter Schmid, Lee Berger, John Hawks for their kind invitation to participate in the Rising Star Workshop at Wits University in May 2014.

Funding program

CGL2015-63648-P, SYNTHESYS+

Hosting institution

Paleoanthropology Group, Department of Paleobiology, Museo Nacional de Ciencias Naturales (MNCN-CSIC), J.G. Abascal 6, 28006 Madrid, Spain

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