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NESPOS - A DIGITAL ARCHIVE AND PLATFORM FOR PLEISTOCENE ARCHAEOLOGY

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Abstract
The increasing amount of data and the growing importance of digital techniques in archaeology and paleoanthropology require a new form of data organization. The wiki-like data base NESPOS was set up as an international cooperation during an EU funded project and has been developing successfully during the last years. Today it offers a broad range of possibilities for researchers and is amongst others curating CT data of human fossils for the Natural History Museum London and functions as a working platform for the European research program EVAN (European Virtual Anthropology Network).

Keywords: data base, Paleolithic, paleoanthropology, archaeology, 3D, CT scans, digital, art, human fossils, artefacts

1 Introduction

The amount of data compiled in palaeoanthropology and in palaeolithic archaeology as well as the techniques of documentation of pleistocene humans and their sites has changed dramatically within the last two decades. Today several thousand archaeological sites comprising a dense set of behavioural and environmental data are known in Europe only. Research on pleistocene humans has become an interdisciplinary task crossing national and international borders being embedded into palaeoanthropology, archaeology, geology, palaeoclimatology, palaeobiology and social sciences. Therefore, state of the art research requires innovative tools to handle this large body of data. At the same time the fragility of human fossils e.g. demands special requirements for an appropriate conservation policy and a responsible cultural heritage management. CT-scanning of fossil hominid remains and palaeoanthropological analysis based on digital 3D data has become an important part of state of the art research (Fig. 1). Therefore, the necessity for a database of hominid remains is expressed regularly (e.g. Delson et al. 2007, Hublin et al. 2008).

Concerning palaeolithic archaeology documentation and publication of palaeolithic objects such as lithic artefacts, bone tools or mobile art is undergoing a rapid

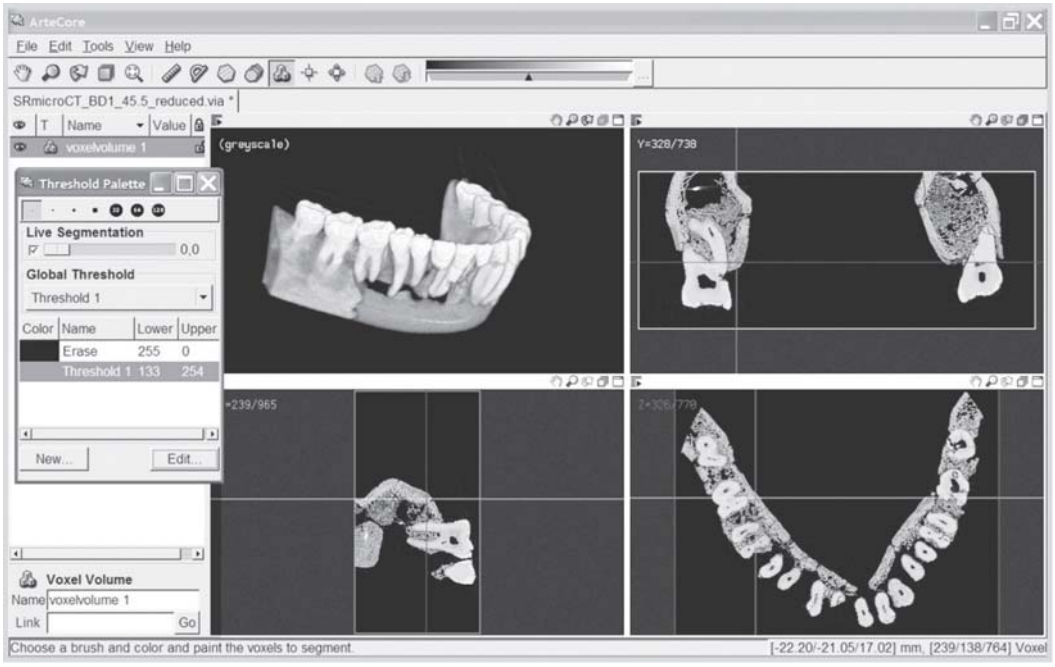

Fig. 1: CT scan of a Neanderthal mandible from Abri Bourgeois-Delaunay (France) edited in ArteCore

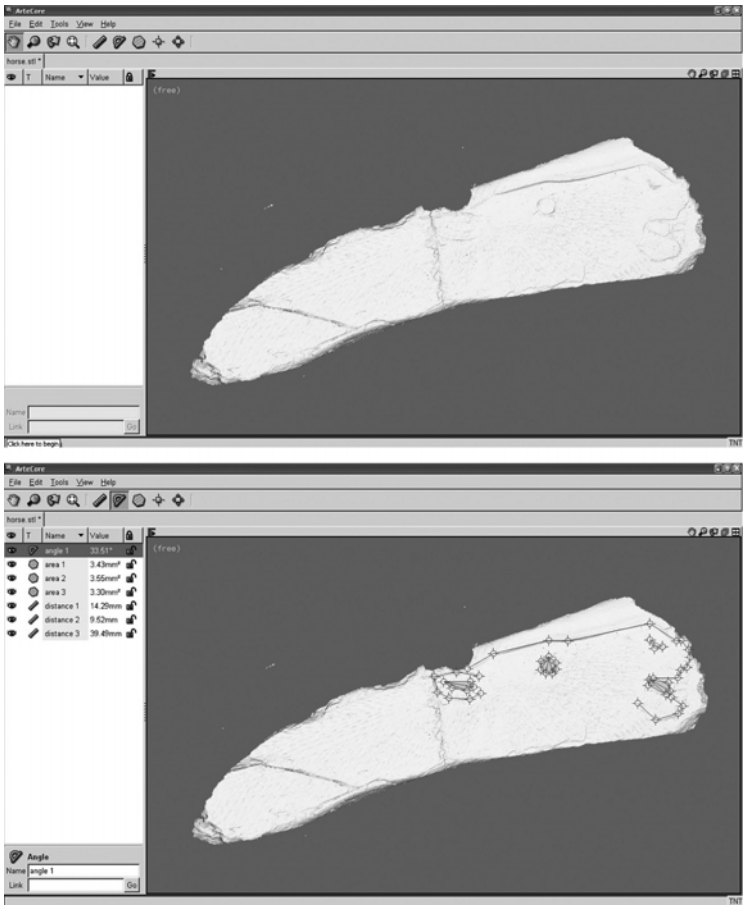

Fig. 2: STL model of a Palaeolithic mobile art object edited in ArteCore

change. For decades drawings of objects were an indispensable part of scientific research and methodology. Although creating a drawing is very time consuming and requires training, photography was not able to replace it because of its reduced abilities to transfer complex technical information. But surface scanning of palaeolithic objects is coming up as a new documentation technique and will substitute in the future drawings as medium for scientific information transfer (Fig. 2). Polygon meshes are of high scientific value because they allow an objective record of the object and its digital measuring (Breuckmann et al. 2009, Slizewski & Semal 2009). Therefore, data bases which allow world wide access are indispensable in the future for archaeological research as well as in palaeoanthropology.

2 History of the project

NESPOS is the first data base project on pleistocene humans that combines all these requirements of archaeology and palaeoanthropology. NESPOS is the result of the 24-months-research project "TNT – The Neanderthal Tools" which started in 2004 and was funded by the European Union. The project was initiated by the Neanderthal Museum and accomplished in close cooperation with the University of Poitiers, the Croatian Museum of Natural History, the Royal Belgium Institute of Natural Sciences and the technical partners Art + Com, Hasso Plattner Institute, PXP and National Geographic (Gröning et al. 2005, Semal et al. 2004, Weniger et al. 2007). Project leader was Art + Com.

NESPOS started in 2006 and was originally designed for a limited number of researchers and 3D data of Neanderthal fossils only (Gröning et al. 2008). It is managed by the international NESPOS Society e.V. a non-profit organization of German law. In June 2009 NESPOS was relaunched as a database of pleistocene people and places. In the course of this relaunch, the database was broadened to all pleistocene sites and human fossils, now also including palaeolithic art, Australopithecines, *Homo erectus*, *Homo heidelbergensis*, anatomically modern humans, and a collection of modern reference data including today's humans, other Hominoidea and Primates. Today it is an open platform, designed for paleoanthropologists and archaeologists worldwide who can up- and download research results.

3 Structure of NESPOS

The data base is bipartite (Fig. 3). The system is the result of adapting enterprise wiki-software Confluence® from Atlassian Pty Ltd. The so called open space is freely accessible via internet. This space contains metadata of sites and human fossils as well as modern reference data. Embedded links to Wikipedia, interactive Google Maps, the possibility to create a RSS feed for NESPOS and many more state of the art Web 2.0 features complete the new functionality of NESPOS.

The NESPOS multimedia space is accessible for members of the NESPOS Society only. Here, all kind of image data are stored CT-scans, surface scans, 6-face models, radiographs and pdf-files of important references. For members NESPOS provides an integrated 3D visual simulation and collaborative rendering engine, the VisiCore Suite. The VisiCore Suite provides a basic archaeological visualisation and annotation tool set that covers the scientific workflow from the topographics of an excavation campaign to the morphometric exploration and documentation of single fossils and artefacts.

Fig. 3: NESPOS Homepage (www.nespos.org)

The VisiCore suite comprises two components: ArteCore, the 3D visualisation tool for fossils and artefacts, and GeoCore, a small GIS and exploration tool for 3D terrain models and virtual excavation sites. It is based on the LandXplorer software. Although various applications already exist for such purposes, VisiCore is attractive because of its integration in an online database and collaboration platform and the only "freeware" that gives students, researchers and institutions with smaller budgets the opportunity to work with this normally upscaled software

ArteCore is able to import CT image stacks, polygonal models, single images as well as pseudo 3D models based on six views of an object (Berens & Slizewski 2008; Fig. 4). In addition to standard exploration tools like real-time rotation, zooming and panning, it offers sophisticated 3D reconstruction tools. Based on ct volume data, polygonisation can be carried out by simply defining a density range or by using a manual segmentation tool, which allows the application of various thresholds at the same time. Morphometric tools include distance, area and volume measurements as well as the setting of landmarks. By saving and exchanging the landmark positions via NESPOS with colleagues' users can jointly work on a specimen.

The visualisation features of GeoCore can be characterised by two different levels: 3D models of site locations and 3D virtual excavation sites (Fig. 5). 3D terrain models offer a wide perspective on the location of archaeological sites within the landscape and 3D models of excavated sites provide an easier understanding of the relative position and orientation of 2D documentations like profiles and excavation maps. If the position of the finds is known, also the 3D distribution of single fossils and artefacts can be visualised.

Fig. 4: 6- face model of a Neanderthal tooth from Hunas (Germany)

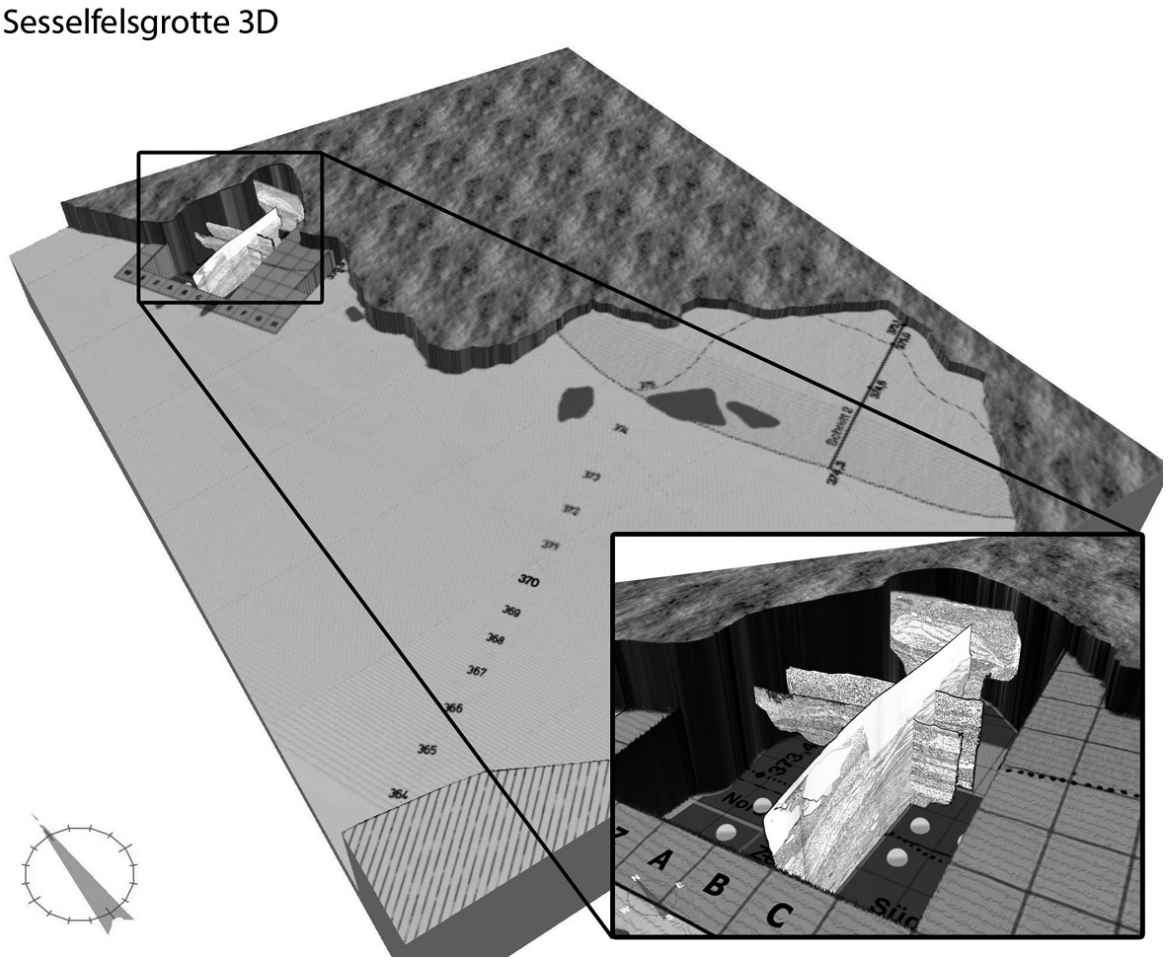

Fig. 5: Site model of Sesselfelsgrotte (Germany) generated with GeoCore

While all multimedia data is protected in a membership area, sensible data can be stored in personal security spaces which are only accessible by the specific member who created it. For working groups like for example EVAN (www.evan.at), a security space can be made accessible to several researchers.

Within NESPOS all related data is linked to each other. By calling up a single fossil you also get information on all other human remains found in the same place, pdfs of literature, site data such as stratigraphy, research history, fauna, archaeological features, and artefacts.

Currently, the NESPOS membership area includes photos, literature, CT data, surface scans and 6-faces of human fossils and artefacts from more than 70 sites in Asia, Europe and Africa. Within an ongoing research project 60 sites from the Iberian Peninsula are in the process of uploading.

Cooperations

By cooperation with the Natural History Museum of London NESPOS administrates fossil hominid CT-scans of the Museum. Further cooperation with leading companies for digital measuring as Delphi Deutschland GmbH (Wuppertal, Germany) and CTM-do GmbH (Dortmund, Germany) offer the possibility to do micro-ct scans up to 5 micron resolution of human fossils and artefacts for museums or institutions which do not have these technicaldevices. This cooperation with private enterprises assures up-to-date equipment.

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