S27 Revealing by visualising: Geographic relations in cultural heritage databases

Mieko Matsumoto, Michael Märker, Espen Uleberg, Volker Hochschild

Cultural heritage databases can easy accommodate, and are often required to contain large quantities of data. It is a challenge to present and convey this data in a manner which provides a comprehensive overview, whilst simultaneously promoting new interpretations and understanding. To continue from the CAA in Siena, we would like to bring together researchers working on varying issues connected to the geographical relationships in cultural heritage and archaeological data. This can include the technical prerequisites of database systems, such as interface solutions that transform geographic, geodetic and 3D data to visualisation tools. We welcome presentations of tools and interfaces that allow the visualisation of this data in web based services, GIS systems, etc. In addition, we also wish to discuss tools for the spatial assessment of data in terms of spatial descriptive statistics and modelling.

Examples of open source solutions are especially welcomed, along with applications that provide an overview of state of the art solutions. Further points of discussion include how to integrate the requirements of the target user and create sustainable systems— here questions of visualisation versus interaction might be relevant.

S27-01 GIS-based data integration for mapping paleoenvironments

Christian Willmes, Daniel Becker, Michael Märker, Volker Hochschild, G. Bareth

Maps depicting environments as they were in a certain time of the past, are very useful tools for researchers working on questions concerning these time periods. Those paleoenvironment maps contextualize data in a defined spatio-temporal frame. For example, to visualize an archaeological finds database containing data of the Alleröd–Interstadial time period, it is desirable to contextualize the find sites on a map displaying according topographic features like glaciation extends and coast lines, and if possible climatic and vegetation regimes of the given time in the region of interest.

Paleoenvironmental studies and according facts (data) are abundantly published in the scientific record. But GIS based paleoenvironmental datasets are relatively scarce. For the here presented project, we present how to acquire and produce GIS datasets from published non-GIS based facts and informations, such as analogous maps, textual informations or figures of scientific publications, and collect them in a database. This database consists of the metadata describing the paleoenvironmental data sources, that allows to query for spatial and temporal features.

This way we aim to make more paleoenvironmental data accessible for GIS based analyses and map creation. Another benefit of the GIS approach is the access to well developed data exchange and data integration techniques, known as Open Geospatial Consortium (OGC) Open Web Services (OWS).

Based on these OGC OWS collaboration (MÄRKER ET AL. 2015) between the CRC806-Database (WILLMES ET AL. 2014) and ROCEEH ROAD (MÄRKER ET AL. 2009) is setup, to exchange GIS data. The presentation will detail technicals of the collaboration between ROAD and CRC806-Database, and will show the data collection workflows and details of data management, as well as some paleoenvironment maps, which were produced in this endeavour.

[References]

MÄRKER, M., KANAEVA, Z. & HOCHSCHILD, V. (2009): Multidisciplinary Integrative Georelational Database for Spatio-Temporal Analysis of Expansion Dynamics of Early Humans. In: FRISCHER B. & GUIDI, G.: Proceedings of CAA, Williamsburg, Virginia, USA. 18.–22.03.2009.

MÄRKER, M., WILLMES, C., HOCHSCHILD, V., BARETH, G. (2015): How to exchange data between DB Systems on Early Humans. A case study based on the SFB 806 DB and the ROCEEH ROAD system. CRC806-Database, University of Cologne, DOI: 10.5880/SFB806.11
WILLMES, C., KÜRNER, D. AND BARETH, G. (2014), Building Research Data Management Infrastructure using Open Source Software. Transactions in GIS, 18: 496–509. doi: 10.1111/tgis.12060.

S27-02 Endangered archaeology in the Middle East and North Africa: The development of a spatial database

Richard Jennings

Archaeological sites across the Middle East and North Africa are under ever increasing risk from a range of threats such as growing population sizes, increased agricultural production, urban development, warfare and looting. The Endangered Archaeology in the Middle East and North Africa project (Eamena), which is based at the University of Oxford and the University of Leicester and is supported by the Arcadia Fund, is in the process of recording endangered sites, many of them unrecorded, from across this region using satellite imagery and aerial photography. The project collaborates with cultural heritage institutions in different countries as well as scientific researchers and all people with a strong interest in the preservation of its rich archaeological heritage.
In this presentation we discuss the development of the spatial database, which underpins the aims and objectives of the project. It is built using the Arches cultural heritage management system, a freely customisable open source software package that complies with to international recording standards. A number of key stages formed part of the database development, including setting out what types of data to record, what terms would make up the semantic vocabularies, ensuring that the structure conformed to CiDOC CRM standards, uploading of legacy datasets and the integration of satellite imagery. The aim is to produce a database that will be publically accessible and is designed to be used by a network of well trained staff in the region, with the skills to record and manage sensitive archaeological sites and landscapes, to ensure that the cultural heritage will be managed in the future.

S27-03 Management of raster data and their dynamic visualization within the ROCEEH─ROAD System

Michael Märker, Volker Hochschild

In the recent past data base systems providing information on early humans and their environment are becoming more and more important and increase rapidly in number. The main aim of the Heidelberg Academy of Sciences and Humanities project entitled "The role of culture in early human expansions (ROCEEH)" is to assess the spreading "out of Africa" in a spatial, cultural and biological context. Implicitly we suppose as working hypothesis that the influence of changing environmental conditions decreased as the importance of cultural and technological innovations grew. The ROCEEH project deals with a variety of variables and formats from geology, geomorphology, palaeontology and archaeology in vector, raster as well as text formats. To achieve the general objectives a georelational spatial information system was developed and implemented. The system is called "The ROCEEH Out of Africa Database (ROAD)". In this paper we focus especially on raster data and their dynamic visualization in order to assess landscape evolution. The ROAD georelational database was designed as flexible as possible to store manipulate and visualize geographic spatial data. Therefore open source software based on the OGC standards was implemented. Moreover, we provide several web map and web processing services based on a backbone structure with a specific raster data management. The latter allow the visualization of dynamic features in

landscape evolution such as topography changes or sea level changes. The acceptance of a database related to early human expansion studies depend very much on the capabilities to explore and visualize the data and to results in a dynamic way. Thus, different levels of interaction must be provided with the system in order to fulfil the manifold user requests.

S27-04 Vertical aspects of Stone Age distribution in Norwegian high mountains
Mieko Matsumoto, Espen Uleberg
This paper will show how the vertical aspects of Stone Age distribution in Norwegian mountains can be visualized through the museum database. This database system developed used by the Norwegian university museums is by now used for cataloguing all new acquisitions. It also contains metadata for the older part s of the collections. These archaeological collections are available through the website www.unimus.no as open data. As of November 2015, around 900 000 entries can be queried and presented. The majority of finds are geotagged, and some of the finds are related to posts in the national sites and monuments register, Askeladden. All finds are annotated with different precision levels ranging from precise location over cadastral unit to municipality and county. Some types of analyses can only be done with objects with precise provenience information, while analyses concerning trends within a larger area can use finds with lower precision levels. These precision levels are therefore decisive when choosing objects for the different analyses. Our project *Dynamic distributions* was concentrated on the visualization of large stone artefacts like axes, sickles and daggers in South-East Norway. These finds are mainly from valleys and agricultural areas. The vertical aspect should include the high mountains, and then it is necessary to take other material types into consideration. One important aspect for the find distribution in the high mountains is the fluctuating tree limit. Soon after the end of the Ice Age, the tree limit was much higher than today. Many of the Stone Age sites that today are interpreted as high mountain sites have been below the tree line in a birch and pine forest. The paper will present different visualizations of artefact type and site distribution across the high mountain region.

POSTER

Cancelled **S27-P1 Distributions of Age at death from Roman Epitaph inscriptions in North Africa: An application of data mining**
Peter Oskar Pflaumer
Thousands of age at death inscriptions from Roman epitaphs in North Africa are statistically analyzed. The Gompertz distribution is used to estimate survivor functions. The smoothed distributions are classified according to the estimation results. Similarities and differences can be detected more easily. Parameters, such as mean, mode, skew and kurtosis are calculated. Cluster analysis provides three typical distributions. The analysis of the force of mortality function of the three clusters yields that the epigraphic sample is not representative for the mortality in North Africa. The results are compared with data from epitaphs from the European provinces. Africa is quite different. The general mortality level is much lower. The African cluster is much more homogenous than the European cluster. The distributions are determined by three factors: Mortality, levels, commemorative processes, and population growth rates.