DIGITAL ARCHAEOLOGY:
DATA ACQUISITION METHODS AND PRACTICES

Session organizer: Sveta Matskevich (University of Haifa)

Chair: Avshalom Karasik (Israel Antiquities Authority)
On-Site 3D-Scanning as the Main Tool for Studying the Architectural Decoration in Herodion

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Analyzing the architectural decoration of a building provides us with chronological information and a broader social context. In Herodion, the architectural decoration assemblage is well preserved, making it a key site for understanding the Herodian decoration and its underlying social processes that mark the transition from a local Hellenized culture to a Romanized one.

As part of the study of the architectural decoration of Herodion, I established a database of more than 400 items, of which more than 70 have already been scanned by a portable 3D-scanner. This project is the largest 3D-scanning project in Israel to date, involving field scanning of column capitals and entablature fragments. These items are bigger and more complex than the mainly 3D-analyzed objects so far: pottery and flint tools. The project aims to study the applicative potential of 3D-scan for architectural elements as a new research method.

The goals of the study concentrate on understanding the carving process and the identity of the artisans that King Herod employed. 3D-scanning produces quick, accurate data, that can be readily analyzed and thus enabling the incorporation of artistic and architectural research methods. The first stage focused on a group of Corinthian capitals from the Fortress-Palace. The 3D-scans enables us conducting several tests that measure the precision (and thus quality) of chiseling. Those tests will help to determine whether a known “standard” for Corinthian capital carving existed. The Herodium 3D-project will give us a better understanding of the Romanization of Judea, a far-reaching process that Herod eagerly led.
Predicting modeling for archeological sites location: comparing logistic regression and Maxent in north Israel and North-East China

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In this study we analyze the distribution of archaeological sites, using a new method of maximal entropy (Maxent). Given the environmental parameters, the model predicts the probability of sites existence. Such models are important tool for preservation of archaeological sites as they can help planners avoid areas where site are likely to exist. The models are also used for research purposes, as an analytic tool to better explain settlement patterns and past human behavior.

The model produces probabilistic values, which can be introduced graphically as a colored maps or a binary map. We found that the results of the Maxent are much better than the common prediction model based on logistic regression.

In the present work, we examine the Maxent models with respect to data collected from two independent areas: The Upper Galilee, Israel and the Fuxin area in northeast China. The model based on a high-resolution systematical survey of those regions together with high quality satellite images.

We also compared Maxent models with Logistic regression models for both study areas (Fuxin in China and Upper Galilee in Israel). The models apply to the same data sets, and it seems that the Maxent maps give better results, according to several characteristics which are used in the literature.
3D Documentation in Field Archaeology: Methods, Workflow and Software Solutions

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The Institute of Archaeology, Hebrew University of Jerusalem In recent years, the development of low-cost powerful computer hardware (CPU & GPU), as well as high-resolution digital cameras, made the 3D documentation accessible to wide-scale archaeological research. In field archaeology, the introduction of 3D documentation allows obtaining digital recording of a site, a layer, or a feature, during the time of its excavation. As the excavation proceeds, exposed layers are often removed to allow access to layers beneath them; features are disassembled, and the site changes tremendously. Since it is impossible to preserve the same state on-site for future examination, the digital 3D documentation is invaluable.

However, digital acquisition of 3D archaeological data has received only limited attention in field projects in Israel, probably due to the professional expertise which is required for exercising these methods successfully. My lecture aims to provide basic review of photogrammetry techniques for achieving high quality 3D documentation. The lecture will review the needs of contemporary archaeological excavation and how these are answered best using 3D documentation. A workflow for its implementation in the field work will be presented. Finally, I will demonstrate, based on my personal experience, several software solutions for the discussed applications.
We will introduce a computer-based procedure for testing technological features in lithic assemblages. This procedure quantifies the degree of variability between a series of lithic assemblages based on the technological “fingerprint” particular to each assemblage. Like other motor skills, the lithic tool manufacturing is proven to be a conservative feature of material culture. Therefore it can bear the stylistic “fingerprint” of a distinct human group which maintained an unchanged manufacturing tradition for a long time, thus allowing us to follow population dynamics in a given geographically area.

The procedure first includes a preliminary traditional technological analysis that allows picking from each assemblage a sample of items representing different stages of the reduction sequence. 3D models of each sampled artifact will be obtained with the structured light scanners available at the Computerized Archaeology Laboratory, Hebrew University of Jerusalem. These models will be processed by Artifact3-D (Matlab®-based suite) providing an automatic positioning and objective measurement of the artifacts. Further analysis, in particular the automatic identification of scars on the artifact surface, will provide us with other features related with manufacturing. Finally, the application of machine learning algorithm will test the degree of variability of these features.

This procedure applied within and between the different assemblages will help obtaining the “fingerprint” of lithic assemblages and quantify the variability between the different technological traditions.

The case study of the lithic assemblages from Ein Gev area (East of the Galilee Sea, Israel), dated to the Early and Middle Epipalaeolithic (ca 24,000 – 15,000 cal BP), will be presented.