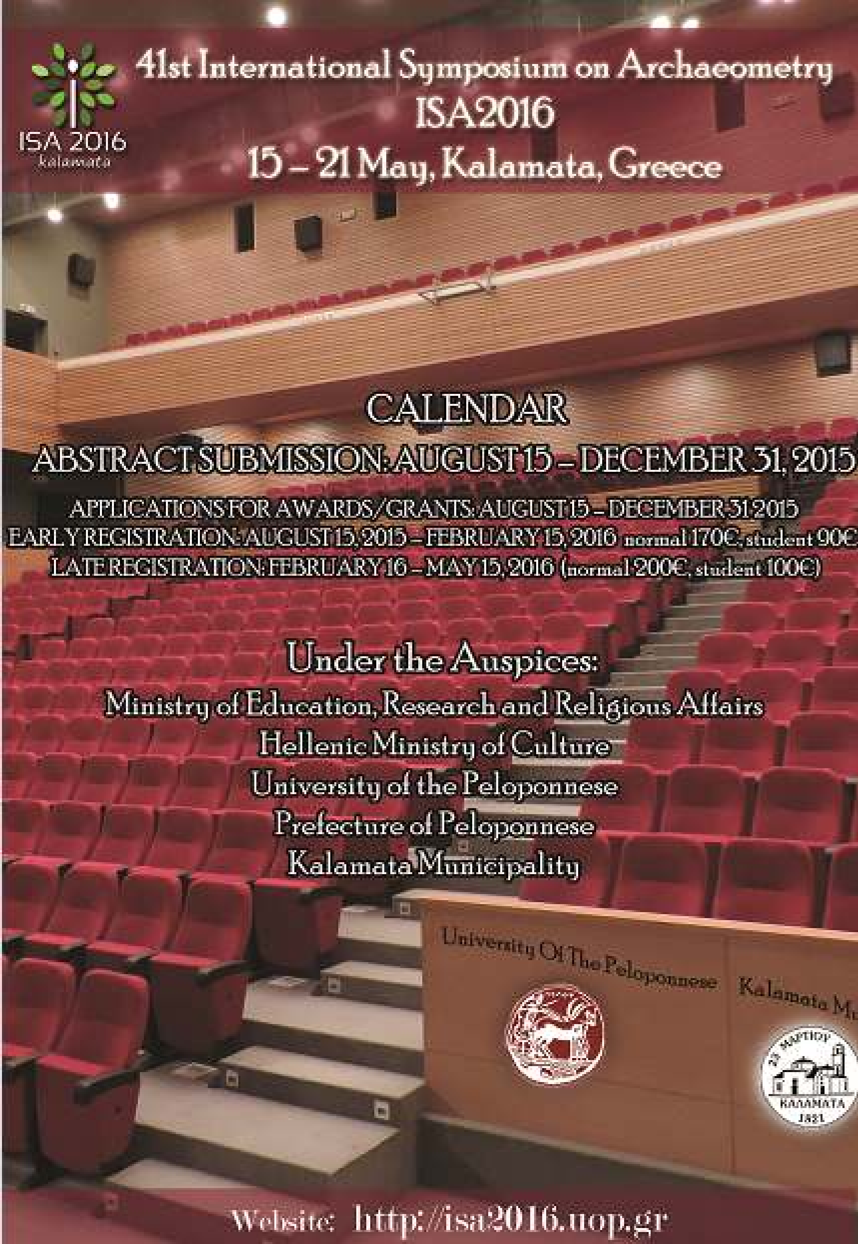
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Creating Interactive 3D Visualizations of Archaeological Data: A Case Study of the Early Bronze Age Helike Corridor House

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1- Introduction

This paper advances understanding of Early Bronze Age house building techniques with particular focus on Corridor Houses.
The case study comes from the EBA site of Helike, situated southeast of Aigion in the Gulf of Corinth, NW Peloponnese, where excavations have revealed an extended EH II and III settlement (2500—2100 BC) (Katsonopoulou 2011; Kormann 2009; Soter et al. 2001). The Helike Corridor House (HCH) is a fine example of a much debated architectural type of structure of the period in the Greek mainland, linked to the hierarchical distribution of wealth and the rise of local chiefdoms. Structural integrity studies have shown that the house was capable of supporting a second floor and that its roof was of a light construction covered by tiles.

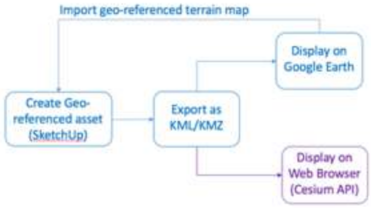

Figure 1: Pipeline (1) Importing the terrain into a CAD package that supports geo-referencing; (2) actual 3D drawing of the model, including texture mapping. At this stage, the exact geo-references are obtained possibly by alternative means if the CAD package does not support geo-referencing. The aim here is to define the geo-referencing parameters that allow the creation of an XML file that can be exported as kml format; (3) creating the XML structure that is compatible with the kml file format, and its equivalent kmz compressed version. Once this is achieved, the file is ready to be open by the Google Earth application, which can also be called from inside a web browser using the Cesium API.

2- 3D Reconstruction Methodology

We are following a model in which digital assets are to be visualized by geo-reference either using the Google Earth interface or directly inside a web browser (3D Engineer 2016; Allen et al. 2004; Haselton 2015).

3- 3D Model Creation and Visualization

Figure 2: Select a geo-located portion of the map.

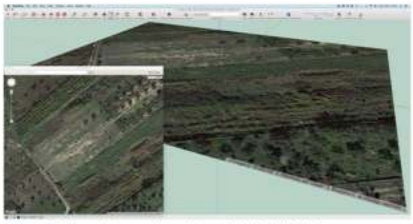

Figure 3: Geo-referenced map imported into SketchUp. The geographic location is displayed centred on the coordinate system of SketchUp. From here on, all models created with SketchUp will be fully geo-referenced and terrain features can be used for correct placing of the models on the map.

Figure 4: Trench map showing the relationship of excavated trenches. Here we produced a single drawing in scale of all trenches, and registered on the terrain by carefully adjusting the size, rotation and translation of the image until all trenches matched their locations.

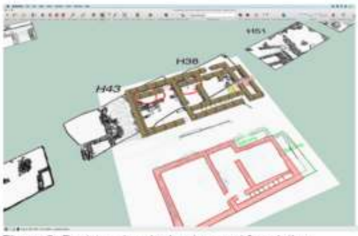

Figure 5: Registered scale drawings and foundation modelling.

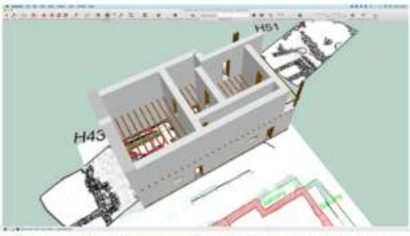

Figure 6: Walls, wooden features to support first floor, doors and balcony are created.

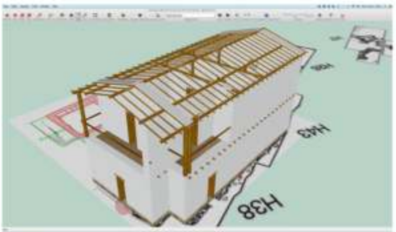

Figure 7: Roof structure and remaining floor features are added to the model.

Figure 8: Details of the model.

Figure 9: Details of the roof.

Figure 10: The exported 3D model to KML format is visualized with overlaid trenches on Google Earth.

Visualization is a powerful tool to convey a message or an idea. It translates data from computer formats to human understandable formats through the use of images, graphical models, charts, and other graphs that humans feel comfortable interpreting.

In this research we are mostly focused on issues concerning interactive visualization in archaeology with open source tools lowering the entry barrier to archaeologists. The requirements of our proposed method are that it must be able to run everywhere from anywhere. The most appropriate interfaces are thus, provided by web browsers whose applications can be developed entirely based on open standards and protocols.

References

(1) 3D Engineer (2016). Google SketchUp Initial Review. [online] http://www.3dengr.com/google-sketchup-initial-review.html last accessed March 2016.

(2) Allen P et al. (2004). Seeing into the Past: Creating a 3D Modeling Pipeline for Archaeological Visualization. Proceedings of the 2nd International Symposium on 3D Data Processing, Visualization and Transmission, 751-758.

(3) Haselton T (2015). Google Earth Pro Now Free for Everyone to Download. TechnoBuffalo [online] http://www.technobuffalo.com/2015/01/31/google-earth-pro-now-free-for-everyone-to-download/ last accessed April 2016.

(4) Isenberg P, Elmqvist N, Scholtz J, Cernea D, Ma K-L, Hagen H (2011). Collaborative Visualization: Definition, Challenges and Research Agenda. Information Visualization 10(4), 310-326.

(5) JavaScript Source (2016). Tutorials [online] http://www.javascriptsource.com/tutorials/ last accessed April 2016.

(6) Jeffrey S (2015). Challenging Heritage Visualisation: Beauty, Aura and Democratisation. Open Archaeology 1 (2015) 144-152.

(7) Katsonopoulou, D (2011). A proto-urban Early Helladic Settlement Found on the Helike Delta. PROTOHELLADIKA-The Southern and Central Greek Mainland, Helike IV (D. Katsonopoulou, ed.), Athens, 63-88.

(8) Kormann M, Katsarou S, Katsonopoulou D and Lock G (2016a). Structural Integrity Modelling of an Early Bronze Age "Corridor House" in Helike of Achaea, NW Peloponnese. In: CAMPANA, S et al (eds.) CAA 2015. Oxford.

(9) Kormann M, Katsarou S, Katsonopoulou D and Lock G (2016b). On roof construction and wall strength: non-linear structural integrity analysis of the Early Bronze Age Helike Corridor House. In: CAA 2016, Oslo, Norway, 29 March to 2 April 2016.

(10) Kormann, M and Lock, G (2013). Dynamic models to reconstruct ancient landscapes. In: CONTRERAS, F. et al. (eds.) CAA 2010: Fusion of Cultures. Oxford.

(11) Kormann, M (2009) Helike Delta, Gulf of Corinth, Greece: An Integrated Dynamic Landscape Model Using GIS. MSc Dissertation. The University of Oxford.

(12) Lock, G (2003). Using Computers in Archaeology: Towards Virtual Pasts. Routledge, London.

(13) Marquardt S (2015). Google Earth Pro is now free. The Official Blog for Google Maps [online] https://maps.googleblog.com/2015/01/google-earth-pro-is-now-free.html last accessed March 2016.

(14) Palyvou, K. (2005) Akrotiri Thera: An Architecture of Affluence 3,500 Years Old. Philadelphia: INSTAP Academic Press.

(15) Sarris A (2015). Best Practices of Geoinformatic Technologies for Mapping of Archaeolandscapes. Archaeopress.

(16) Shaw, J.W. (2007). Sequencing the EH II Corridor Houses. BSA (102), 137-151.

(17) Soter S, Blackwelder P, Tziavos C, Katsonopoulou D, Hood T, and Alvarez-Zarikian C. (2001). Environmental Analysis of Cores from the Helike Delta, Gulf of Corinth, Greece. Journal of Coastal Research 17(1):95–106.

(18) W3schools (2016). JavaScript Tutorial. [online] http://www.w3schools.com/js/ last accessed April 2016.

4- Discussion and Conclusion

This paper has visualized house design and building techniques in the EBA, using the Helike Corridor House as a case study.
A full 3D model of the Helike Corridor House was created with a tiled roof based on archaeological evidence from the foundation walls and from related corridor houses of the period (The Weisses House on Aegina and The House of the Tiles at Lerna, Shaw 2007). The model was used to verify the monumental scale of the house, built from Adobe brick. Our previous simulation studies (Kormann et al., 2016a) have shown that an earlier EH II rectilinear ground floor design was modified into a corridor type of building. The doubling of external walls to form corridors and accommodate stairways access to the upper floor together with internal divisions were necessary innovations to ensure the house integrity concerning its susceptibility to buckling and its ability to support a second floor. A long external wall at the back of the house was made 1.5 times thicker than the adjoining walls in order to decrease its susceptibility to buckling.

Structural integrity studies concerning roof design (Kormann et al., 2016b) demonstrated that the house would be able to support a tiled roof. However, if the roof were of a heavy construction (compare with roofs of the period with a wooden structure, a layer of reeds, a layer of mud and a thick layer of rammed earth in the Cyclades; Palyvou 2005), the walls would not be able to support it and the house would collapse. This points to sophisticated construction techniques in the period with roofs made of a wooden structure, a layer of reeds, followed by a thin layer of clay and tiles. The research also supports the argument for specialization of planning and architectural design in the period. The corridor houses at Helike, Aegina and Lerna are strikingly similar, keeping a scale of 1:1.5 between them: Aegina is about 1.5 larger than Helike concerning length, width and wall thicknesses, and Lerna is 1.5 larger than Aegina again concerning length, width and wall thicknesses.
Such similarities may account for a scenario in which the house plan and building techniques were standardized across the region, in response to social changes: rising hierarchies, intensification of trade, need for common storage space, an assembly hall to host the chief.

In conclusion, for the application of 3D models to support structural integrity studies and visualization over the Internet for the HCH, we investigated open access technologies and opted for a combination of SketchUP and Google Earth to demonstrate the concepts. We examined the methodology for creating geo-referenced 3D models using SketchUp by direct manipulation of the geographic area. Once the 3D model is built, textures were added from a set of images using SketchUp functionality. Finally, the 3D model was exported to KML format such that it can be displayed on mapping applications such as Google Earth, Cesium, and web browsers.