The virtual Chichén Itzá project: modelling an ancient Maya city in Google SketchUp

Beniamino Volta, Thomas E. Levy & Geoffrey E. Braswell

Background

The rapid pace of development in information technologies is radically changing the ways in which archaeologists carry out their research. Geographic Information Systems (GIS) software and digital recording methods have had a substantial impact in archaeology over the past decade (Aldenderfer & Maschner 1996; Friedman *et al.* 2003; Levy & Smith 2007). Along with powerful GIS tools for recording and analysing spatial data, archaeologists have also benefited from the visualisation capabilities of 3D modelling programs (Gillings & Goodrick 1996; Forte & Siliotti 1997; Terras 1999), bringing the field one step closer to the 'virtual archaeology' envisioned in Reilly's (1990) seminal article.

Google SketchUp is a powerful modelling program with an intuitive and user-friendly interface that is available for free download from Google. Models created in SketchUp can be integrated in a variety of presentations, from screenshot images to be used as illustrations in reports and publications to interactive reconstructions that users can experience in Google Earth, Second Life, or other virtual-reality environments. Three-dimensional visualisations produced with this method can also aid researchers in data analysis, as spatial patterns of structures or artefacts can be easily viewed and manipulated in the models.



Figure 1. *Screenshot of a Google SketchUp model of structures 2D1 (Great Ballcourt), 2D3 (Platform of the Eagles), and 2D5 (Castillo) at Chichén Itzá, superimposed on the Carnegie Institution's map of the site.*

Google SketchUp and the CISA3 Project

The potential for applying Google SketchUp to archaeological visualisations is being explored by the authors in a collaborative project with the Center of Interdisciplinary Science for Art, Architecture and Archaeology (CISA3) at the University of California, San Diego. The initial aim of the project has been to develop a method for modelling archaeological buildings and landscapes in SketchUp starting with survey and excavation data. The long-term goals include the creation of a 'virtual city' for the Maya archaeological site of Chichén Itzá, Yucatán, Mexico, where Braswell and Volta will be conducting research over the next four years. The integration of SketchUp models and GIS data into a web-based interactive research environment is also being investigated.

https://doi.org/10.15184/S2978855200903238 Published online by Cambridge University Press



Figure 2. *UCSD graduate student Misha Miller-Sisson (at the total station) with workers Vicente Caamal Martínez (right) and Ubaldo Cen Uc surveying a residential group in the south-western periphery of the site during the 2009 field season.*

Chichén Itzá: building a virtual Maya city

The CISA3 Virtual Maya Cities project has the goal of modelling an entire ancient city: Chichén Itzá, one of the largest and most powerful centres in the Maya region of northern Yucatán, Mexico, during the Terminal Classic period (AD 800-1050/1100). Over the next few years, an international team of archaeologists led by director Rafael Cobos of the Autonomous University of Yucatán and including Braswell and Volta will conduct extensive mapping and excavations at Chichén Itzá, a UNESCO World Heritage site. The results of this research will be incorporated into a digital model of the site (Figure 1) which will allow viewers to explore the ruins virtually. This is especially important in light of the huge impact that tourism is having on the site. Thanks to the inclusion of substantial survey data (Figure 2), the model will represent Chichén Itzá as the large and complex urban settlement it was, and not as just an empty ceremonial core that tourists visit today (Magnoni *et al.* 2007). By exploring alternative ways of allowing the public to experience Chichén Itzá, it is hoped that the project will have an educational effect while contributing to the preservation of the site.

In preparation for the spring 2009 fieldwork at Chichén Itzá, SketchUp models were created of the structures included in the portion of the site surveyed by the Carnegie Institution of Washington, D.C., at the beginning of the twentieth century. The reconstructions were based on the general plan of the site published by the Carnegie project (Ruppert 1952; Tozzer 1957), as well as more recent survey and excavation reports (Lincoln 1990; Cobos 2003) and photographs of the buildings.

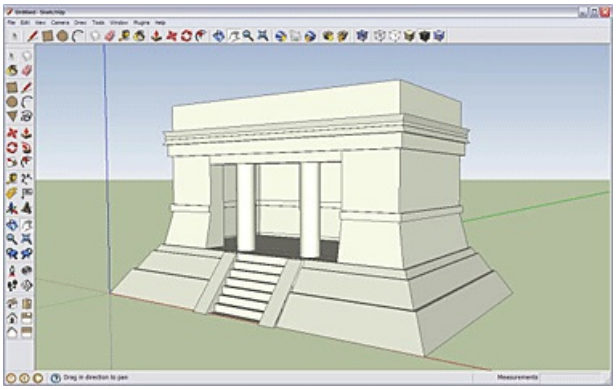


Figure 3. *SketchUp model of the North Temple of the Great Ballcourt based on reports and modern photographs.*

https://doi.org/10.15184/S2978855200903238 Published online by Cambridge University Press

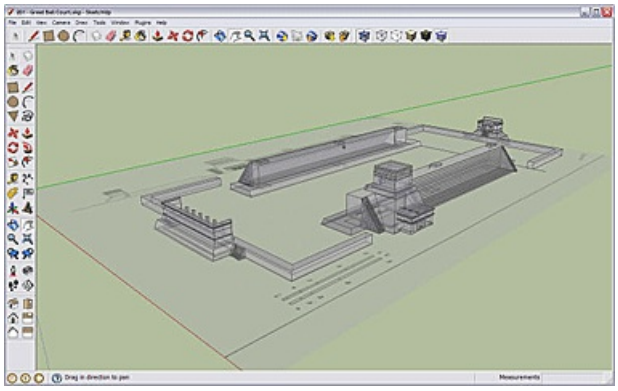


Figure 4. *SketchUp model of the Great Ballcourt in 'x-ray' mode superimposed on a plan of the building.*



Figure 5. *Screenshot of SketchUp model of the Great Ballcourt imported into Google Earth.*

Three-dimensional models can be created based on survey data and building plans by simply tracing the structure outlines in SketchUp and then extruding sections of the drawing according to the heights recorded in the profile (Figure 3). For more complex architecture, such as that of the Great Ballcourt (Figure 4), photos from multiple angles can be used to fill in the details that are not included in structure plans and profiles.

The results of new excavations in the site centre and surveys in the periphery will be added to the model as work proceeds. In addition to its ease of use, one of the main advantages of Google SketchUp is that models created with the program can include as little or as much details as wished, thus allowing for the incorporation of fine-grained reconstructions of excavated buildings alongside more hypothetical renderings based on survey data. In addition, by linking the site database with the models, useful information can be displayed through Google Earth 'balloons' (Figure 5), allowing researchers to explain the fieldwork, post updates, or include any other type of content they desire.

Acknowledgements

We would like to thank Dr. Rafael Cobos and the Instituto Nacional de Antropología e Historia (INAH) of Mexico for supporting our project.

References

- ALDENDERFER, M. & H.D.G. MASCHNER. 1996. *Anthropology, space, and Geographic Information Systems*. Oxford: Oxford University Press.
- COBOS, R. 2003. The settlement patterns of Chichén Itzá, Yucatán, México. Unpublished PhD dissertation, Tulane University.
- CISA3 Center of Interdisciplinary Science for Art, Architecture and Archaeology at the California

https://doi.org/10.15184/S2978855200903238 Published online by Cambridge University Press

Institute of Telecommunication and Information Technology (Calit2): http://cisa3.calit2.net
- FORTE, M. & A. SILIOTTI. 1997. *Virtual archaeology: re-creating ancient worlds*. New York: Harry N. Abrams.
- FRIEDMAN, R.A., J.R. STEIN & T. BLACKHORSE JR. 2003. A study of a pre-Columbian irrigation system at Newcomb, New Mexico. *Journal of GIS in Archaeology* 1: 4-10.
- GILLINGS, M. & G.T. GOODRICK. 1996. Sensuous and reflexive GIS: exploring visualisation and VRML. *Internet Archaeology* 1. http://intarch.ac.uk/journal/issue1/gillings_index.html
- LEVY, T.E. & N.G. SMITH. 2007. On-site digital archaeology: GIS-based excavation recording in Southern Jordan, in T.E. Levy, M. Daviau, R. Younker & M.M. Sher (ed.). *Crossing Jordan - North American contributions to the archaeology of Jordan*: 47-58. London: Equinox.
- LINCOLN, C.E. 1990. Ethnicity and social organization at Chichen Itza, Yucatan, Mexico. Unpublished PhD dissertation, Harvard University.
- MAGNONI, A., T. ARDREN & S. HUTSON. 2007. Tourism in the Mundo Maya: inventions and (mis)representations of Maya identities and heritage.*Archaeologies: Journal of the World Archaeological Congress* 3(3): 353-83.
- REILLY, P. 1990. Towards a virtual archaeology, in K. Lockyear & S. Rahtz (ed.) *Computer applications in archaeology* (British Archaeological Reports International Series 565): 133-9. Oxford: Archaeopress.
- RUPPERT, K. 1952. *Chichen Itza: architectural notes and plans* (Carnegie Institution of Washington Publication 595). Washington (DC): Carnegie Institution of Washington.
- TERRAS, M. 1999. A virtual tomb for Kelvingrove: virtual reality, archaeology and education. *Internet Archaeology* 7. http://intarch.ac.uk/journal/issue7/terras_index.html
- TOZZER, A.M. 1957. *Chichen Itza and its Cenote of Sacrifice: a comparative study of contemporaneous Maya and Toltec* (Memoirs of the Peabody Museum 11 & 12). Cambridge (MA): Harvard University.

Authors

- **Beniamino Volta, Thomas E. Levy & Geoffrey E. Braswell**
Department of Anthropology, University of California-San Diego, 9500 Gilman Drive, La Jolla, CA 92093-0532, USA

https://doi.org/10.15184/S2978855200903238 Published online by Cambridge University Press