Proceedings of the 38th Annual Conference on Computer Applications and Quantitative Methods in Archaeology, CAA2010
F. Contreras, M. Farjas and F.J. Melero (eds.)

Illuminating Historical Architecture: The House of the Drinking Contest at Antioch

Gruber, E.[1], Dobbins, J.[2]

[1] Web Applications Developer/3D Modeler, University of Virginia, USA
[2] Professor, Classical Art and Archaeology, University of Virginia, USA
{ewg4x,dobbins}@virginia.edu

The House of the Drinking Contest is a third century A.D. Roman house from Seleucia Pieria, the port city of Antioch. Numerous fine quality mosaics were lifted when the house was excavated in the 1930s and redistributed to several museums in the United States and one in Turkey. With the aid of modern technology, the house has been reconstructed digitally and its mosaics reinserted. Lighting simulation and sightline analysis have been conducted to recontextualize the mosaics, enabling a greater understanding of the interaction between the natural architectural environments and how residents integrated these environments into social settings.

Keywords: 3D Reconstruction, Roman Archaeology, Light Simulation

1. Introduction

As archaeology is inherently interdisciplinary, scholars have become increasingly reliant on technological tools to aid in all facets of the research process, from excavation to cataloging to illustration. Among these technologies is 3D visualization. Computer modeling not only enables dynamic illustration of a cultural heritage site, but also provides a framework for analyzing complex problems and challenging previously established hypotheses in ways that otherwise could never have been considered. As Sorin Hermon puts it, "VR and 3D visualization of concepts, objects or spaces and their contextualization provide a visual framework in which the data is displayed (HERMON, 2008)." It is therefore important when developing and analyzing a 3D reconstruction of an archaeological site to ask research questions that can only be addressed with the model.

Software platforms facilitate not just architectural reconstruction, but also visualization of a site's natural environment. Terrain data may be integrated into a model and accurate, georeferenced sunlight can be rendered in order to simulate the environment that the inhabitants of a site had experienced. A test case for these technologies is the House of the Drinking Contest, an early third century A.D. Roman house from Seleucia Pieria, the port town of Antioch-on-the-Orontes (modern Antakya, Turkey).

2. The House of the Drinking Contest: A Brief Description

The House of the Drinking Contest dates from the Severan period (ca. 200-230) and derives its name from a large floor mosaic found in the triclinium (dining room, Figure 1, A) that depicts the mythological scene of Herakles challenging the god of wine, Dionysos, to a drinking contest. The mosaic is bordered on three sides by a rich geometric pattern in the canonical U-shaped arrangement that defines the location of the klinai, or dining couches, in Roman triclinia. The house, like many other structures in Antioch, was excavated by the Committee for the Excavation of Antioch and its Vicinity during the 1930s, supported by the Princeton University Department of Art and Archaeology, the Louvre, Baltimore Museum of Art and the Worcester Art Museum. The drinking contest mosaic is in the Princeton University Art Museum, while the other fine-quality mosaics from the house can now be found in several American art museums, with the exception of one mosaic depicting Eros and Psyche, which is in the Hatay Archaeological Museum in Antakya. Like the mosaic of the drinking contest, this also depicts a Greek mythological scene. Eros sleeps under a tree while Psyche takes his bow and quiver of arrows. On either side of the scene are geometric panels bordered by a guilloche. The mosaic was originally in the eastern arm of a portico (Figure 1, B). A triple doorway, a common architectural motif in large, late Roman houses,

provided entrance to the triclinium. The patron and his guests would likely have entered through the middle door, maximizing the impact of the Drinking Contest mosaic and other decoration in the room. Servants probably used the side doors during meals so not to obstruct the view into the courtyard (Figure 1, D) (ELLIS, 1997).

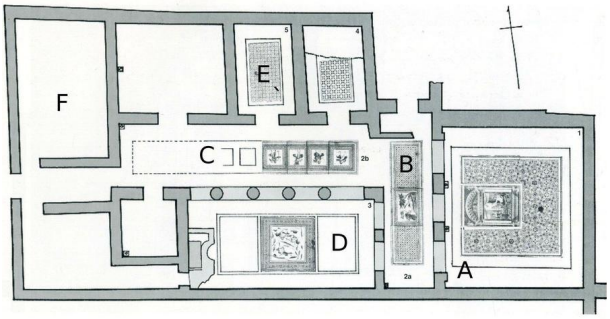

Figure 1: *Plan of the House of the Drinking Contest. A) Triclinium. B) Eros and Psyche Mosaic, main entrance. C) Colonnaded walkway. D) Open courtyard. E) Northern rooms. F). Service rooms.*

On the floor of the northern arm of the portico (Figure 1, C) is a mosaic of squares panels. The four easternmost panels are well preserved, and in them were figural representations of each season in the form of an *eros*, oriented toward the northern rooms (Figure 1, E). These panels are in the Virginia Museum of Fine Arts in Richmond. The courtyard contained a large, marine-themed mosaic (now in the Museum of Fine Arts, Boston) bordered on the east and west sides by a geometric, diamond pattern. Along the western wall of the courtyard was a *nymphaeum*, or fountain. The floors of two of the northern rooms were paved with rectangular geometric mosaics, now in the art museums of St. Petersburg, Florida and Denver, Colorado. The westernmost rooms of the house were likely service and storage areas (Figure 1, F). One of the two doors opens into the western wall of the house, but this was almost certainly a service entrance. Guests would have entered from the north into the eastern arm of the colonnaded portico.

Although many of the house's mosaics were preserved under earth that accumulated over the site, the architecture of the house is in a very ruined state. Despite this, it is one of the few houses excavated at Antioch in which a nearly complete plan has been recovered, and therefore it is possible to reconstruct it.

3. Methodology

Based on the plan and the evidence for columns on the stylobate, the height of the house can be estimated with a high degree of probability. The plan (Figure 1) indicates that the columns were 0.9 meters in diameter. Although Vitruvius' description of dimensions of the classical orders of columns is not universally correct, the 10:1 and 9:1 height to width ratios of Corinthian and Ionic columns, respectively, would have been too tall in relation to the overall dimensions of the house. Therefore, a median ratio for Doric columns (5.5:1) was used for the colonnade. Therefore, the columns were about five meters from floor to abacus, and the entablature of the colonnade is one-quarter the height of the columns (1.25 meters), and from this total measurement, the height of the roofs of the house can then be established. The northern rooms were hypothesized to carry a second story, and small, square windows were inserted into the wall of the second story.

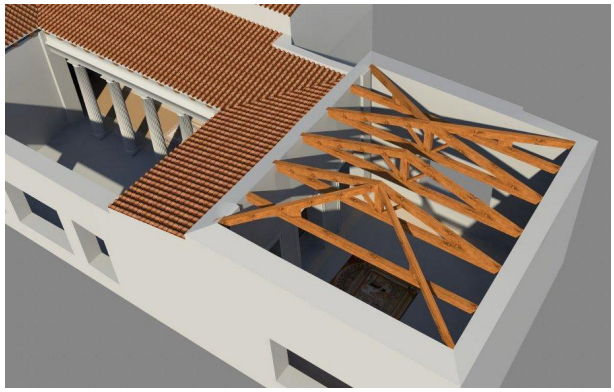

Figure 2: *Triclinium reconstruction.*

The roof on three sides of the courtyard was modeled based on other reconstructions, particularly the porticos of the Villa at Oplontis. The *triclinium* is reconstructed with a high, coffered ceiling, and above this, the roof is constructed of A-beam truss architecture—a likely construction for a squarish room (Figure 2).

After reconstructing the architectural environment of the house in Autodesk Maya, images of the mosaics were inserted into the spaces they originally occupied 1,800 years ago.

Before the lighting simulation script can be applied to a model, several pieces of information are required. The north orientation of the structure must be known. Many plans may have an arrow, but it is advisable to verify the angle by comparing it to satellite imagery from Google Earth, if available. The latitude and longitude of the structure must also be known. In the case of sites excavated in an era before meticulous documentation became a primary archaeological methodology, Google Earth can also be used to accurately locate the site. The precise latitude and longitude of the House of the Drinking Contest was not recorded in the excavation reports, nor are the remains visible in satellite imagery, but the location was found by comparing in situ photographs from the 1930s with modern photographs georeferenced in Google Earth. By comparing natural features exhibited in photographs taken in both eras, the location of the house has been pinpointed to within one or two hundred meters of a precise terrace on a hill, a reasonable margin of error on a global scale. After the latitude and longitude were determined, it was possible to proceed with an accurate lighting simulation.

Figure 3: *Axonometric view of the house from the southwest.*

Using a Maya script developed by Thijs Welman, lecturer at Technische Universiteit Delft, an artificial sunlight was calibrated to the latitude and longitude of Seleucia Pieria and its astronomical position throughout the year of A.D. 230. The script enables the user to calibrate the light to any minute in history back to 2000 B.C., and therefore would have many uses outside the scope of this specific visualization project. The script can also animate the light in a sequence throughout a particular day or year. Consequently, we have rendered time-lapse image sequences into videos that we presented at CAA in April, 2010, and one is available at http://people.virginia.edu/~ewg4x/hotdc/caa-hdc-medium.mov.

4. Results

4.1. Lighting Simulation

The most notable result to arise from the lighting simulation is the environment within the *triclinium*. As the sun set in the spring and summer, rays of light would shine at a low enough angle as to enter through the doors of the *triclinium* and into the center of the room, illuminating the mosaic of the drinking contest. This would occur from 5:30 PM onward, perhaps after dinner festivities had begun (Figure 4).

Figure 4: *Triclinium, evening in spring.*

Since light and shadows in the house are affected by walls and roofs, it was important to simulate the sunlight in an alternate reconstruction, and thus test the validity of the findings outlined above. Three-dimensional models are easily manipulated to show multiple hypotheses, and the same simulations were executed on a model with lowered columns. The columns were modified to reflect the minimal 4:1 height to width ratio of the Doric columns. In total, the roofs were lowered 1.75m (1.4m for columns and 0.35m for the entablature). The alteration had no major impact on light cast by the setting of the sun in the spring and summer months. Only a much higher western roof would have blocked the entry of light into the *triclinium*, and such a high roof is unlikely considering the projected column height in relation to the length and width of the house. Simon Ellis' simulations of other late Roman houses in the East affirms the probability of light entering the *triclinium*, illuminating the mosaic of the drinking contest between Herakles and Dionysos, and figuring prominently in the social dining experience.

Ellis pioneered lighting simulation in Roman domestic architecture with a publication on an experimental methodology in the 1994 *Theoretical Roman Archaeology Conference* proceedings. Ellis states that many urban dining rooms were not very well lit. Some rooms lacked clerestory lighting; others lacked sufficiently large courtyards from which to receive sunlight; and others were forced to be oriented north, and thus did not receive direct sunlight at all. Artificial lighting would have been essential in many of these dining environments, even before the sun had set. In the case of one late Roman house that Ellis analyzed, an experiment utilizing ray tracing of a 3D model of a *triclinium* at the *Batiment de L'Huileme* in Salamis, Cyprus, indicated that light focused on the dining apse in the late afternoon and evening and that reflected "indirect" light played a great role in illumination (ELLIS, 1994). Though dining in an apse with large, semicircular tables and couches did not become common until the late third century, natural illumination of the dining area remained as important as it had been in earlier structures, such as the House of the Drinking Contest, which received direct sunlight through the triple doors on the west side of the room in the spring and summer months and through a hypothesized picture window in the south wall of the *triclinium* (more on windows below). This knowledge, which could not have been gathered without the aid of a computer model, is important for analyzing the Roman social environment in relation to the artistic content in the room and the role that the natural environment plays in connecting the two.

In addition to the discovery of the interaction of sunlight with the mosaic and diners in the *triclinium* of the House of the Drinking Contest, it was observed that the portico effectively shielded the rooms north of the colonnade (possibly bedrooms, but there is no firm evidence to confirm that) from direct sunlight during the hottest months of the year. Since summers in the Hatay region can become quite hot, the portico served a functional purpose in addition to an aesthetic one.

4.2. Sight-line Analysis

Final analysis of the 3D model yielded not only interesting results regarding simulated lighting of the house, but also of sight lines connecting occupants in certain spaces to architectural features within the house or geographical features outside of it. The plan indicates that the four columns were not evenly spaced. John Dobbins postulated that they were spaced accordingly so as not to obstruct a theoretical view to the south from each of the northern rooms, and thus the reconstruction is informed by the likelihood of large picture windows in the southern wall of the courtyard (DOBBINS, 2000). This theory was formulated after observing one of the *in situ* photographs taken during the 1930s excavation of the house (STILLWELL, 1941: p. 32, Figure 38). Figure 5 shows the remains of the house from the slope just to the north. The coastline of the eastern Mediterranean Sea and Mount Casius, 16 km further south, are clearly visible. The terrain slopes from the southern edge of the house down to the coast, making it unlikely other structures would have obstructed the vista.

Figure 5: *Southern view to Mount Casius with mosaics in situ.*

A photograph from Google Earth was georeferenced to almost the precise location of the house, and it was integrated into the model for analytical purposes (Figure 6). The model tested the sight lines proposed by Dobbins and reinforced his hypothesis. From these rooms, one would have been able to look directly south without obstruction to Mount Casius (Figure 7).

Views to the outside were also a fundamental element of the dining experience. Roman authors such as Pliny (*Ep*. 2.17.5, 5.6.19-20) and Sidonius (*Carm*. 22.215-20, *Ep*. 2.2.12) emphasize the view from the main reception room as an important feature of any house. Ellis suggests that the view through the triple doors of late houses into courtyards were the most meaningful view to outdoor environments (ELLIS, 1997). Since windows in the courtyard wall providing views to Mount Casius appear to have been likely, a similar window is restored in the *triclinium* to accommodate the same view.

Figure 6: *Photograph copyright Panoramio user Cüneyt Kırbaş.*

Figure 7: *View from the middle of the northern rooms.*

The so-called *oecus* of the House of M. Fabius Rufus in Pompeii (VII.16.17-22) contained six large picture windows which looked westward toward the sea. The apsidal room may have been used for dining (Figure 8).

Figure 8: *House of M. Fabius Rufus, Pompeii. Apsidal room with windows facing the sea.*

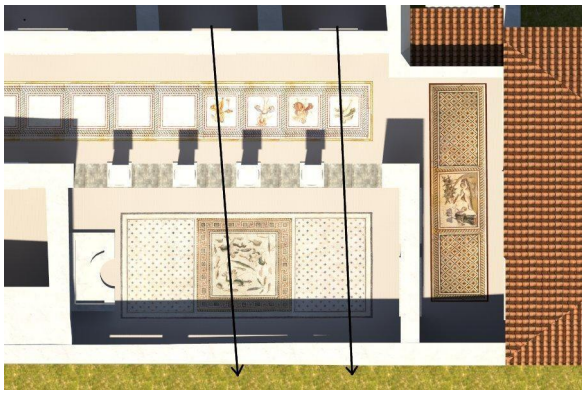

Figure 9: *Sight-lines through the house and beyond.*

A closer regional parallel is found in the late imperial houses at Zeugma, on the Euphrates. These houses predate the Sassanian destruction of the city in A.D. 252, and are from the same era as the grand houses of Antioch and the towns in its vicinity. Large iron window grills were found *in situ* in one house. There is also good evidence for large windows looking into interior courtyards based on substantial finds of glass. Houses throughout the Roman Empire were influenced by local tastes, and thus evidence for large windows in third century houses at Zeugma reinforces the probability of picture windows in the House of the Drinking Contest in Seleucia Pieria. In any case, the houses from Pompeii and Zeugma indicate that large windows provided occupants with views to either interior courtyard spaces or geographical features in the distance, and that such windows would be probable in the House of the Drinking Contest, especially considering the importance of viewing from within the house.

The model of the house was also instrumental in providing an explanation for the non-symmetrical composition of the marine pavement in the courtyard. The three eros-riding-dolphin groups are not displayed in a regular triangular formation within the square border. Instead, two of the groups are set near the "bottom" of the square, when viewed from the north, and each group is canted toward one of the sides. The explanation for this condition had been readily available to scholars, including co-author Dobbins, for years in the plan with its mosaics inserted (Figure 1), but no one had recognized it. It was only when we were studying the 3D model that the simple answer presented itself with great clarity. The 3D model allowed us to creatively assume the roles of ambulatory ancient spectators much more effectively than the plan had. Within the new environment of the model, we were aware of moving through space in a more vivid way than previously. Arrows in Figure 9 indicate that sight lines extend from the two northern rooms, cross two of the season mosaics, extend between two intercolumniations, enter the courtyard, and finally go beyond the house to the eastern edge of the Mediterranean Sea and to the peak of Mount Casius in the distance. The model reveals with 3D vividness that a spectator walking along the trajectory of the arrows would encounter one or the other of the erotes groups, which are set and angled as they are to be seen correctly by spectators moving along those two dominant trajectories.

In addition to testing sight lines from the northern rooms to the natural environment external to the house, the model also allowed for testing of sight lines between features within it. The patron of the house, while reclining at the traditional position on his couch, would have been able to see through the doors of the *triclinium* in order to gaze at the *nymphaeum* on the western edge of the courtyard (Figure 10). The nymphaeum-portico-*triclinium* connection is a common theme throughout Antiochene houses, and the 3D model of the House of the Drinking Contest illustrates this relationship effectively (STILLWELL, 1961).

Future Plans and Conclusions

The model is an invaluable tool for analyzing the house. The next logical step in using the model to learn about the Roman dining environment is to simulate artificial light in the *triclinium* once the sun set. It is possible in Maya to simulate a candle flame based on the burning temperature of the fuel, in this case, olive oil. Given examples of candelabras which can be found in numerous museums throughout the United States and Europe, these artifacts can be reconstructed digitally and inserted into the *triclinium*. Another important aspect of lighting simulation of ancient architecture is to calibrate the rendering engine to the human eye's ability to adapt to darker spaces. Making sound judgments on what can be seen or not seen in a simulated virtual environment requires great accuracy on the part of the rendering engine to produce an image that is nearly identical to what one would have seen in the actual house nearly two thousand years ago. The ocular adjustment that occurs when one moves from lighter spaces to darker ones is mathematically calculable, and thus should be entered into the rendering process to enhance the accuracy of hypotheses discussed in the paper.

The modeling project began in early 2009, and although the original intent of the project was strictly academic, the interest by museum curators and educational staffs in obtaining access to the virtual environment of the House of the Drinking Contest soon became obvious. Such a

Figure 10: *Triclinium-to-nymphaeum view.*

display would be a great accompaniment to the works of art themselves. A museum-goer could see the mosaic in person and then view the mosaic in its original context. This dual approach to providing access to objects of cultural and artistic significance is technologically feasible, but not often undertaken. The model can be inserted into a real-time environment, such as Unity 3D. The environment could be accessed via a kiosk or even online. It is preferable to use an engine that enables a user to modify the date and time of the simulation in order to observe the change in light. In sum, the model of the House of the Drinking Contest was designed for academic purposes (testing hypotheses of reconstruction, lighting, and sight lines), but it can also serve an instructional role in a museum gallery.

This project illustrates the importance of lighting simulation in architectural reconstruction and how the methodology may invoke a new and more accurate level of comprehension of ancient environments. The mosaics from the House of the Drinking Contest can be seen today in museums, but they have been removed from their original context. When the house was inhabited in the third century, the occupants perceived the mosaics differently from the way scholars and the general public view them now. By recontextualizing the mosaics, one can better understand the role they played in Roman society. Lighting simulation of reconstructions of cultural heritage sites can be broadly applied across the discipline of archaeology, and its potential in reshaping scholarly perception of the sites cannot be overstated.

References

CIMOK, F., 2000. *Antioch Mosaics*. A Turizm Yayinlari, Istanbul.

DOBBINS, J., 2000. The Houses of Antioch. In Kondoleon, C. (ed.) *Antioch: The Lost Ancient City*. Worcester Art Museum, Worcester.

ELLIS, S., 1994. Lighting in Late Roman Houses. *TRAC 94: Proceedings of the Fourth Annual Theoretical Roman Archaeology Conference, Durham, 1994,* pp: 65-72.

ELLIS, S., 1997. Late-antique dining: architecture, furnishings and behaviour. In Laurence, Ray and Andrew Wallace-Hadrill (eds.) *Domestic Space in the Roman World: Pompeii and Beyond*. Journal of Roman Archaeology Supplementary Series Number 22, Portsmouth, Rhode Island.

ELLIS, S., 2000. *Roman Housing*. Duckworth, London.

JONES, F., 1981. Antioch Mosaics in Princeton. *Record of the Art Museum, Princeton University* vol. 40.2, pp:2-26.

STILLWELL, R., 1941. *Antioch-on-the-Orontes* Vol. 3, *The Excavations 1937-1939*. Princeton University Press, Princeton.

STILLWELL, R., 1961. Houses of Antioch. *Dumbarton Oaks Papers* vol. 15, pp: 45-57.

ULRICH, R., 2007. *Roman Woodworking*. Yale University Press, New Haven and London.