Virtual Reconstruction of the ancient Synagogue of Susyia, Israel using Real Time Virtual Technology

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Introduction- Technology

- Virtual reconstruction, used for pleasing gamers, has been incorporated for urban simulation
  - This application can range from:
    - Design
    - Emergency actions plans
    - Reconstruction of excavations
Introduction- Technology (2)

- The researches at UCLA’s Urban Simulation team have reconstructed the entire Los Angeles Basin.
  - They claim that it is an alternative to viewing complex designs and plans

- Research shows that with a shift of archaeological recording to representation in 3D environments display allows for the user to:
  - Navigate through the data
  - Create a connection between present day objects and their contexts
  - Reveal misunderstanding that were created either by years of aging or by field word

(Katsainis, Tsipidis and Kotsakis)
Introduction- Archeological

• Archeological information ranges form measurements, to history, to digital aids

• For this reconstruction, the researcher, has created charts to organize the measurements for the different parts of the building

• Measurements have been archived from a variety of different sources
Introduction- Archeological (2)

• Susiya:
  – Dates back to the 5th Century CE
  – Located in Khirbet Susiya
    • situated 750 meters (about 2,250 feet) above sea level in the Southern Hebron Mountains

• The remains of the synagogue and the site were excavated between 1969 and 1972 by the late Shmaria Guttman

• Archeologist believe the synagogue was in use continuously by the Jewish residents of Susiya between the 5th Century CE to the 9th Century CE

• It was then abandoned and destroyed

• Later a mosque was built above the synagogue.
Introduction - Archeological (3)

- Visual aids such as image A, B, and C are being used for this project.
  - The images are used as visual aids to help the reconstructor make the project as realistic as possible
  - Images can also be used as layering surfaces
Research Goal

• The primary goal of this research project is to reconstruct the ancient synagogue of Susiya, Israel, using real time virtual reality technology.

• This reconstruction will be done using 3D Studio Max.

• The reconstruction will be created on a user friendly interface which will operate at personal leisure.
The Learning Process

• Learning Autodesk 3D Studio Max
  – Learn basic concepts:
    • Modeling polygons, editable mesh, editable poly
    • Carving
    • Using scales and measurements

• Recording learning and modeling process
  – This researcher will be using print screens to document his progress
    • Captioning every image with date and section
Topography/Terrain

• The first step of the three dimensional virtual reconstruction of the ancient synagogue of Susiya, Israel was the construction of the terrain

• The same program that was used to reconstruct the synagogue complex itself
Topography Map
Sketched Contour Lines
Completed Terrain
Modeling the Courtyard

• Three dimensional blueprints were created

• Once the courtyard was completed, the walls, columns, and arches were extruded to their correct height

• Most time was spent on arches
Arches
Arches (2)
Modeling the Eastern Wing

• The model was not created in multiple files, but rather in isolation mode

• The first step was to create all doors into the prayer hall and the adjacent halls were created

• Then the benches, the doors, and roof were created
Creating the Second Floor

• Details about the second floor were very scarce

• Speculations were made that the second floor extended over the main prayer hall

• The model does not include the second story over the prayer hall
Texturing

• If not done correctly, no matter how precise and detailed the model may be, the final outcome can look sloppy and unprofessional

• Completed using a process known as UV Texturing, also known as UV Mapping
UV Mapping

- UV Mapping is a way of changing a 2D image into a 3D image. Image I shows a perfect example of UV Mapping.

- A 3 dimensional image (shown at the far left) is digitally “folded” to cover a 3D image.

\[
\begin{align*}
    u &= \sin \theta \cos \phi = \frac{x}{\sqrt{x^2 + y^2 + z^2}} \\
    v &= \sin \theta \sin \phi = \frac{y}{\sqrt{x^2 + y^2 + z^2}}
\end{align*}
\]
Conclusion

• The final model represents the synagogue of Susiya, Israel as it was in use during the 4th and 5th Centuries CE