The Visual Model for the Paul's Cross Project

By David Hill

David Hill is an associate professor in the School of Architecture at North Carolina State University.

The research team based the digital model construction on primary source reference material such as period engravings and paintings of the churchyard, scanned architectural drawings by Sir Christopher Wren, and contemporary plans of the cathedral's foundations—dimensionally precise drawings based on John Schofield's recent archaeological surveys. Architecture graduate students implemented software packages that are typical in professional architectural practice to translate the two-dimensional source drawings into three-dimensional virtual models. Initially, the research assistants created base digital drawing files—plans, sections, and elevations—using AutoDesk AutoCad. Within this program, the students arranged overlays to precisely align the multiple source drawings, and then used these to derive a composite set of comprehensive working drawings. The working drawings formed a basis for constructing the digital models in Trimble SketchUp, a program that enabled the team to synthesize construction details into a formally, spatially, and materially accurate representation of the cathedral. Using VRay, a rendering engine plug-in to SketchUp, the team added greater visual detail to the cathedral model by simulating context-, date-, and time-specific light and atmospheric qualities. Additionally, Vray enabled the team to represent material and textural characteristics of stone and glass that comprise the cathedral's facades and buttresses. The team refined the resulting images, postprocessing them within Adobe Photoshop.

For video production, it was necessary to export the SketchUp model into AutoDesk 3D Studio to utilize the program's camera and scene-rate control capabilities. The final video circumnavigation of the courtyard contained over 4,000 frames, requiring the computational strength of a robust new render farm at the Hunt Library. Exhibiting the video in the library's Teaching and Visualization Lab venue presented a significant opportunity to project the video across an 80-foot-long, 270-degree screen. This also posed a major challenge. The screen's configuration and extremely horizontal aspect ratio required Scott Williams, a systems programmer at the library, to write custom code for the video rendering process. Since this was the first video installation in the Teaching and Visualization Lab, the video rendering required several iterations to work out issues within the code and the digital model to achieve the desired result.

Through the digital modeling process, the team determined that two separate models would be necessary: one for visual simulation, and one for audio production. These two models—both produced in SketchUp—required different degrees of detail. While the architecture student research assistants were more familiar with the process of modeling for visual presentations, they achieved a sufficient audio model only after several attempts to eliminate extraneous details that did not contribute to an accurate auralization of the space. Feedback from Acentech was critical to the modeling team's understanding of the digital model requirements.

Lessons Learned

The collaborative nature of this project was crucial to its success. It would have been impossible without the contributions of participants in architecture, audio engineering, information technology, archaeology, history, and an authority on John Donne. Post-Reformation scholars likely do not spend time learning the latest building simulation software. And while architects might have the technical skills to build digital models, they are not necessarily experts in audio

engineering or 17th century poets. Frequent communication among team members from various fields combined with advice and oversight from an advisory committee ensured the project's success.