Kaihuasi: Buddhist art and virtual reality

The Kaihuasi (開化寺) is a Buddhist monastery located about 17 km north of the city of Gaoping (開平) in southeast Shansi province. The monastery was established in the 6th century and expanded in the 10th to 11th centuries under the supervision of the Chan Master Daoji (道基). The Kaihuasi is especially known for its main hall, the Daxiongbaodian [大雄寶殿] (Mahāvīra Hall), which was built in 1092 during the Northern Song. The interior of the Daxiongbaodian is decorated with exquisite Buddhist mural paintings that have been preserved from the 11th century.

In 2017, a research team of the Experimental Teaching Center for Virtual Reality and Simulation in Archaeology at Peking University used Virtual Reality (VR) technology to record the monastery including the main hall and its murals. First, the team deployed drones to take pictures of the monastery complex from an aerial view. Then panoramic photography was used to record both the interior and exterior of each building (fig. 1). In order to virtually reconstruct the building structure and mural paintings in the Daxiongbaodian, the team took 181 high-resolution photographs and used photogrammetry to create a 3D model of the Daxiongbaodian (interior) with surface texture and color information. In other words, the photos were applied as skins to precisely cover the surface of the 3D model of the building’s interior (fig. 2). After all data was collected, the team located all buildings on a map using the Geographic Information System (GIS). The links to the panoramic photographs were pinpointed on the aerial picture according to the real locations where the photos had been taken. The links to the 3D models with surface texture were also displayed on the map.

Aside from documentation, this VR project has also been applied to enhance the experience of museum visitors. In the spring of 2017, the Arthur M. Sackler Museum of Art and Archaeology at Peking University exhibited high-resolution photographs and copies of the wall paintings from the Kaihuasi. In addition to viewing the paintings in two dimensions, visitors were able to wear a VR headset and immerse themselves in the virtual scene of the Daxiongbaodian to experience the painting and the building structure in their original spatial context. VR would help museums to redesign and/or upgrade traditional exhibitions, and to protect historical architecture from potential damage made by flocking visitors.

Using the VR technology to document art and architecture is only the team’s first step. The benefits and challenges of the application of VR and other digital technologies will be further discussed in a panel titled ‘Digital Humanities and New Directions in Studying East Asian Art and Architecture’ at the 2018 Annual Conference of the Asian Studies (AAS), to take place in Washington D.C. this March. The panel, organized by Fletcher John Coleman, will present more original digital humanities projects and explore new directions in East Asian art and architectural history.

The Kaihuasi is only one example in the team’s database called VR-Heritage that stores hundreds (currently around 150) of temples and buildings dated from the 10th century to the early 20th century. This database can help scholars, professors, and students to discover new problems and generate new research topics. For example, the team has developed several themes such as ‘Song-Jin architecture in southeast Shanxi’, ‘Yuan-Ming architecture in Sichuan’, and ‘Liao pagan in Inner Mongolia and Liaoning’. Most of the objects are Buddhist architecture or monuments.

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China Connections

Digital Buddhism

Guest Editor

Di Luo

Longmen Grottoes: New Perspectives

Fletcher John Coleman

On 25-28 October 2017, Harvard University welcomed a team of experts from the Longmen Grottoes Research Academy to present a joint-initiative focused on digital conservation and restoration. An enduring legacy to Chinese art is the UNESCO World Heritage Site of the Longmen Grottoes represents over a millennium of religious and creative activity. The ‘Longmen Grottoes: New Perspectives’ workshop brought together Longmen Grottoes Research Academy researchers with specialists on Buddhist art from across the globe to promote cutting-edge efforts at digital preservation, archaeological work, and documentary projects taking place at Longmen.

Spearheaded by Eugene Wang, Abby Aldrich Rockefeller Professor of Asian Art at Harvard University, and Hou Xuke, Director of the Material and Information Center at the Longmen Grottoes, the two-day event was centered on overviews of recent digital programs at Longmen. Tasked with addressing centuries of damage and dispersal of the magnificent limestone grotto sculptures, the Longmen Grottoes Research Academy began a comprehensive project of 3-D scanning across a decade ago. Having built an extensive database of cave scans, the Academy uses the information to conduct new efforts at preservation — including the redressing of ground-up according to the real locations where the photos had been taken. The links to the 3D models with surface texture were also displayed on the map.

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Notes


2. The VR-Heritage is a database developed by Peking University in 2017. It aims to record important cultural heritage sites with panoramic photography, oblique-imagery 3D modeling, and other VR technologies. It is currently under construction and will be accessible for academic use in 2 or 3 years.

Fig. 1: Panoramic photograph of the Daxiongbaodian at Kaihuasi (built in 1092). Photo by Yunan Wu.

Fig. 2: Steps of creating the 3D model of Daxiongbaodian (interior). Photos by Yunan Wu.

(a) Point cloud image generated by photogrammetry.
(b) Triangle mesh model converted from the point cloud image.
(c) Triangle mesh model with surface texture and color information.
(d) Anaglyph of Daxiongbaodian, its 3D effect viewed by wearing 3D red cyan glasses.

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