A PICTURE IS WORTH 1,000 PASTS : HOW 3D VIRTUAL RECONSTRUCTIONS CAN BRIDGE THE GAP BETWEEN VISITOR INTEREST AND SCHOLARLY DEBATE

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Abstract – 3D reconstructions allow cultural institutions such as museums and historic sites a tool to vividly illustrate the past while educating the public about competing interpretations of history and change over time. 3D technology also offers many practical benefits including low cost, flexibility, and the potential for collaboration. This paper presents potential applications of 3D reconstructions for three example sites: the Church of the Holy Sepulchre in Jerusalem, the Castillo San Marcos in St. Augustine, Florida, and the Old North Church in Boston, Massachusetts.

INTRODUCTION

For years curators have struggled to condense the complex and even contradictory findings of recent scholarship into exhibits that remain engaging and entertaining to museum patrons. Visual presentations often prove especially difficult, as designers must make large speculative leaps to produce coherent illustrations, dioramas, or film clips, and thus commit to permanent, passive images of the past. But with the advent of 3D modelling and animation technology, curators may now produce illustrations that can deftly display nuance, uncertainty, and academic debate with a visual flair not possible with traditional techniques. Using practical examples from historical sites around the world, this paper will show how virtual reconstructions can educate visitors about the many possibilities of the past in visually rich, coherent, and interactive exhibits.

PRACTICAL ADVANTAGES OF 3D RECONSTRUCIONS

Virtual 3D reconstructions uniquely allow curators to present multiple visions of the past in an appealing interactive format. In the historical field and especially in early periods where scholarship may only be a piecemeal assembly of archaeological data, vague records, and a few surviving artefacts, 3D technology can transform a museum's approach. It permits curators to display alternate visions of the past, and allows patrons to cycle back and forth between tangible interpretations of competing scholarship.

These flexible representations also prevent curators from settling on a false compromise between two competing theories that no scholar would endorse.

Using 3D reconstructions for virtual exhibition displays also allows curators a unique degree of cost-effective flexibility. Normally, a new scholarly discovery can quickly make obsolete the careful work of a traditional model maker or illustrator. But museum designers working in 3D can simply return to their original model file, altering details of the scene in hours or the entire scene layout itself in a few days. Responsive institutions can use regular updates to disseminate new findings quickly, while creating new programming, and inviting the public to consider the collective and contested nature of historical inquiry.

3D reconstructions also can address the challenge of the public's historical memory. Many errant interpretations of the historical past take on an iconic significance and are cherished in the public mind. The same applications of 3D reconstructions can quickly contrast fanciful traditional interpretations with more sound modern views. One historical example might be the famous statue of the *Colossus at Rhodes*, one of the Seven Wonders of the Ancient World. Medieval illustrators interpreted records from antiquity as suggesting that the massive human statue stood straddling the city's harbour entrance, allowing ships to sail between its legs. This romantic depiction became a recurring image in Western art, but modern historical research and engineering science suggest a straddled statue would be impossible, and the Colossus more likely had an upright pose on a single shore, much like New York's Statue of Liberty. Through comparative 3D reconstructions a curator could preserve the enticing picture of the implausible statue design that many visitors would expect, while still presenting to current state of archaeological knowledge.

Illustrating the past in 3D reconstructions also allows for flexibility between multiple output formats. Still renderings can take the place of traditional hand drawn illustrations or photography, but can be produced from any perspective in a given scene. Animations for use in broadcast television, home video, or the web can be produced in varying levels of detail appropriate to each medium. The most exciting applications are interactive displays, where models could provide the basis for video game style walk throughs in real time game engines, or a variety of user interfaces for web or institutional networks including in Flash animations. The use of low detail versions of 3D models could also soon allow similar applications to run on mobile devices like the iPhone or Blackberry. Last, unlike other illustration approaches, only one initial creative production is required to provide the content for each of these applications.

Projects that use 3D modelling for illustrative displays may also stimulate unique collaborative projects between cultural institutions. For a given reconstruction, experts at different museums and historic sites could advise content creators in designing a particular scene. These partners could split development costs but share equally in the licensing rights for the reconstruction. Such work could promote links between institutions that work in the same area but have distinct collections. An accurately reconstructed Egyptian tomb, for instance, might include the placement of artefacts held in a half dozen museums, and allowing partners to advertise their holdings in other markets.

The rapidly declining cost and level of necessary training required for 3D reconstructions continues to make them an appropriate tool for cultural institutions of all sizes. Most high end 3D suites will now run on consumer desktop computers, and are capable of producing scenes that approach photorealism depending on the skill of the designer and the complexity of the model. In recent years many advanced features of 3D rendering have become achievable in small studio settings. These include scientifically correct lighting techniques that produce realistic reflections, caustics, and employ subsurface scattering to recreate translucent materials. The combination of 3D sculpting programs and normal mapping allows artists to add significant detail to 3D surfaces without seriously taxing computing power.

When complete, 3D reconstructions also offer a longevity that preserves the hard work of creators for use in future projects and in the face of emerging technologies. Anytime digital artists create a given reconstruction, each of the elements they construct can be transferred for use in future scenes, from material textures to architectural details. Carefully made models should also weather the advent of new technologies, and could be used in future applications from stereoscopic 3D presentations, to 3D printers that could make physical models out of the virtual scenes.

This paper will investigate the potential application of 3D reconstructions in three operating historic sites of with varying sizes, budgets, clientele, and priorities. Although these examples will focus primarily on the illustration of historic architecture, the technique of using 3D modelling to add complexity and contingency to public learning displays could be applied to any number of other fields. A natural history museum, for instance, might show the differing views of two scientists on the appearance of a prehistoric animal that has survived only as an incomplete fossilized skeleton. Regardless of the field, 3D illustrations can improve the impact and educational value of public learning presentations.

EXAMPLE 1 – THE CHURCH OF THE HOLY SEPULCHRE, JERUSALEM

Creating a visual reconstruction of a historical site or artefact from which little or no physical material survives involves a number of tremendous interpretive leaps. As the most important Christian site in Jerusalem, the present day Church of the Holy Sepulchre reflects centuries of late medieval construction and more modern repairs. But little more than foundation stones remain of the original Byzantine version of the church. It was a dramatically different structure that dominated the skyline for centuries in Jerusalem before damage during the Muslim conquest and final destruction in the Crusader era. Any display seeking to inform visitors about this crucial period in the church's history would need to evaluate the relative merits of a number of very different and even contradictory pieces of evidence.

This difficulty is apparent when considering the aedicule, the small shrine covering the grotto reputed to be the empty tomb of Jesus. Church officials and pilgrims made brief accounts of their visits to the aedicule, but gave little specific information. Visual evidence is similarly sparse, limited to simple, stylized depictions on coins, medallions, and rings, as well as a few painted depictions, likely made hundreds of miles away and

many months after visits to Jerusalem. Similar problems affect the record of imitation shrines in Europe, which returning pilgrims built to honour their memory of the aedicule. Any reconstruction of the shrine must piece together these few clues, while referencing the styles and materials of other surviving Byzantine church sites to complete the vision. No matter what decisions are made, the resulting image would be highly speculative with regard to many key elements.

An interactive electronic display using 3D models could demonstrate this uncertainty to visitors in an entertaining and visually appealing format. Members of the public would first see an institution's preferred interpretation, as with a traditional illustration. But the virtual exhibit could then show visitors the primary pieces of visual evidence, from the small copy of the tomb unearthed in a demolition in Narbonne France, to another simple depiction in a stylized mosaic from the floor of a Jordanian church. Accompanying text or narration would explain the differing designs each piece of evidence seems to suggest, after which visitors could view alternate reconstructions that privilege one clue over another. These would quickly teach the public about how seemingly minor details from records can radically transform an interpretation.

Similar applications of 3D reconstructions could be used to envision other uncertain aspects of the church's original appearance. The Byzantine building was not a single structure but a massive religious complex in which pilgrims successively passed through an opening atrium, a massive basilica style church, a second atrium built around the supposedly rock of Calvary, and finally a towering rotunda church, which housed the aedicule over the purported site of Christ's tomb. 3D reconstructions could depict the possible subject matter of the elaborate mosaics that likely decorated the walls, and display alternate colours for the marble used in the basilica's many columns. Ancient documents refer to the second atrium as the "garden," and reconstructions could show twin interpretations of this term, the first as a regular plaza named in honour of the place of Jesus' suffering, and the second as an actual atrium garden with manicured plants and a long pool. Just as with the aedicule, displays could show visitors firsthand the competing interpretations built on individual pieces of visual evidence.

Figure 1. A concept design for an interactive exhibit showing differing reconstructions of the Holy Sepulchre's aedicule, and corresponding pieces of historical evidence.

EXAMPLE 2 – CASTILLO SAN MARCOS, ST. AUGUSTINE, FLORIDA

A 3D reconstruction would also prove useful at a historic site that affected its entire surrounding landscape, like the Spanish colonial Castillo San Marcos fort in St. Augustine, Florida. The hulking castle there protected the north eastern border of the Spanish American empire for decades, and later sheltered British colonists and United States troops during subsequent regimes. Like the Holy Sepulchre, the fort passed through multiple distinct eras, with different elements added during multiple construction periods. The first decades of Spanish settlement had hosted nine consecutive palisade forts before construction began on a stone castle following a brutal attack by English pirates in 1668. Workers constructed each of the castles four bastions in sequence so that some part of the structure would be defensible before the building was completed around 1692. Constant maintenance and minor alterations continued until a significant redesign in 1737, expanding the plan of the fort to include a ring of reinforced bombproof rooms under the main walls to shelter provincials during future attacks.

3D reconstructions could depict these changes visually with a realism and accuracy impossible in another format. An animated flyby can quickly show how a given change alters the strategic landscape. Visitors could understand visually the topography of St. Augustine's harbour and where ships would have had to navigate to shell the town. They could see how the firing range of the fort increased with each completed section, and how long it would take for messengers to travel from outposts with warnings, or townspeople to make their way into the safety of the fort during an attack.

Modelling in 3D could also show how the fort's construction and operation transformed the city's urban development and local ecology. Recent improvements in specialized 3D software have made it much easier to recreate realistic natural environments, like St. Augustine's surrounding countryside. Skilled artists can now more quickly reproduce natural terrain, vegetation, and water to depict environmental changes like coastal erosion as well as human alterations of the countryside such as clearing trees, draining swamps, planting fields, fencing off herds, or digging canals. In Florida, colonial Spanish officials cleared large expanses of land of brush and even growing crops to prevent any cover for the approaching enemy. To guard against coastal erosion caused by tides and even hurricanes, the town built a stalwart seawall. The safety of the fort tempted the city's wealthy to built their homes closer to its site on the north end of town, while Native Americans from allied tribes put up refugee camps under the fort walls after English raiding displaced them. Later additional fortifications were built around the town's perimeter, along with stone watchtowers a few miles away that further complicated the strategic and social significance of the present historical site.

A 3D modelled animation showing the passage of time could depict centuries of these developments in only seconds, and even reveal visual patterns in the growth of the city, where each new house and building appeared at the appropriate time, rather than in a set number of different views from major historical eras. These slow and large scale transformations are among the most difficult for scholars to appropriately convey

through traditional means, but 3D animation solutions would allow for visitors to quickly comprehend the geographical and ecological transformations relating to Florida's historic castle.

EXAMPLE 3 – OLD NORTH CHURCH, BOSTON, MASSACHUSETTS

The Old North Church in Boston, Massachusetts has maintained the general form of its colonial construction for decades, but even its presentation still represents a particular and incomplete historical interpretation. Properly named Christ Church, the structure is the work of Boston's early Anglican community, then a minority supporting the state church in a town full of dissenting Puritans. It had been a significant architectural innovation for the colonial community in the 1720's, bolding mimicking the architecture of the famed Christopher Wren, with a tall, landmark steeple that was a great departure from the stout and modest Puritan meetinghouses of the day. The Old North church served many of Boston's most prominent early families, but it earned its notoriety in the public imagination due its experience during the American revolutionary war. A number of church members were prominent American patriots, and the stately spire may have even held the lanterns that signalled the legendary ride of Paul Revere to warn colonial militiamen of the approach of British regular troops.

Local cultural authorities have restored the church to approximate its condition during the colonial period. But even though their mission is centred on such a relatively small span of time, their physical interpretation still requires compromises. One problem is the gradual nature of the church's construction. While the basic form of the church was built by 1730, other key elements like the large rear organ and the iconic steeple were not finished for years later. In their physical representation, the site has chosen to harmonize the different eras to represent the entire span of colonial operation, creating a space much different than many of its famous historical members ever occupied.

Surprisingly, the most dramatically altered feature of the reconstructed church may be the whitewashed walls and ceiling. This aesthetic is common to many New England churches up into the present day, but historical research and archaeology have revealed the original Old North looked much different. Archival receipts to a painter who worked on the building suggest that the pillars and walls once had elaborately painted faux marble finishes, while the ceiling space may have hosted intricate depictions of cherubs. Paint coring samples from the site have confirmed a more colourful past, with traces remaining from a variety of bright pigments.

Other compromises exist because Old North is still an operating house of worship with regular attendees. Although curators have reconstructed the distinctive high box pews of the colonial era, they are now neat and polished bare seating spaces. In the colonial period, families would lease these pews for years at a time, and personalize them with their own wallpaper, lighting, and individual furniture. Decorating each of the pews to period standards would hardly be practical in community space, but virtual environments offer other possibilities.

A capable 3D reconstruction of the church would meet all of the shortcomings of the current physical representation. A display model could allow visitors to cycle through pictures showing the addition of each new architectural feature as it was added, viewing the church as it would have looked for a particular historical episode. Recreations of the original paint scheme on the model could show the dramatic impact on the atmosphere of the space, and an interactive demo might even allow visitors to virtually sketch their own digital doodles on the blank walls. A similar interactive display could allow patrons to decorate their own pew bench, picking from a selection of accurately rendered historical furnishings. 3D reconstructions would allow site owners to quickly rectify all of the compromises required by presenting an extant physical space as a historical reconstruction.

CONCLUSION

Museums and historic sites should never seek to replace the sensory experience of walking through a historic building or seeing a centuries old artefact with one's own eyes. But by using 3D reconstructions in a variety of formats, curators can avoid the trying decision of which single interpretation they will present. Instead they can show visitors competing visions and reflect change over time in exhibitions that are also richer, more engaging, and more efficient than traditional dioramas or illustrations. Some institutions are already making limited use of these techniques, but the more fully curators realize the technology's potential, the more effective educational vehicles museums and historic sites will become.

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