

# Learning through virtual reality: Virtual Bethel case study

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**Abstract.** Focusing on the challenges of teaching virtual reality creation and preservation, our paper will present a case study involving the virtual recreation of the Bethel AME Church sanctuary. We were particularly interested in students' skills, the technology, and costs associated with teaching and learning virtual reality, and how these factors influence overall student learning experiences. Two courses are explored: 3D Production and Digital Preservation. We have learned that teaching and learning in this space is technology and skill intensive. By assessing the skills and technology needed as well as the costs and student experiences, we are better able to communicate the needs of these projects to potential funders and collaborators. We've determined that without external funding, we are currently at capacity and will need funding for additional collaborative projects. The level of technical ability of the students influenced their level of satisfaction as well as their capacity to learn.

**Keywords:** Virtual reality, 3D modeling, Digital preservation, Instruction

## 1 Introduction

Virtual reality utilizes 3D content creation of images, spaces, and animations to implement fully digital-virtual recreations of historical artifacts and spaces. Experiencing spaces in virtual and mixed realities provides an impactful, contextual, and immersive environment for learning history and conducting research with digital artifacts. Use of virtual reality (usually built on game engines) is expanding in digital humanities as a research and education tool. Entire spaces can be replicated to allow the user to immerse herself in spaces that no longer exist due to time, historical events, or inaccessibility. This case study will focus on one such space, the Bethel AME Church of Indianapolis. Though the church building is on both state and national historic registries, the site will be repurposed for commercial use through the sale of the building.

Focusing on the challenges of teaching virtual reality creation and preservation, our paper will present a case study involving the virtual recreation of the Bethel AME Church sanctuary. We were particularly interested in students' skills, the technology, and costs associated with teaching and learning virtual reality, and how these factors influence overall student learning experiences. Teaching virtual reality interaction and content creation is becoming increasingly critical for media-intensive research and virtual reality competency is an asset to practicing professionals in diverse fields: professions such as law, medicine, and architecture are employing 3D and virtual reality in their practice. Teaching the preservation of virtual reality is important for the same reasons. Intellectual output in the form of virtual reality products adds complexity to contemporary and future scholarly communication: the development of any academic or professional body of knowledge requires citation, reexamination, and building on the output of predecessors. Unfortunately, the preservation of virtual reality is more complex and the future much less certain than the creation of virtual experiences.

## 2 Background on the Bethel AME Church of Indianapolis, IN, USA

Bethel is the oldest African American church in the city of Indianapolis, and was once a vital part of a thriving African American community in the heart of the Indiana Avenue Jazz District. The Church was founded in Indianapolis in 1836, and its archive documents a shared heritage and a living community. Over its 180 years of existence, the Bethel AME Church has played a vital role in the Underground Railroad, the founding of the National Association for the Advancement of Colored People (NAACP) in Indiana, the founding of the first formal School for Black Children in Indianapolis, and the development of the African Methodist Episcopal Church in the United States. In the 1960s and the 1970s, the development of the Federal interstate highway system and of Indiana University–Purdue University Indianapolis (IUPUI) displaced many members of the community over the course of just a few decades. Where the church was once surrounded by the homes and businesses of its members, high-end condominiums now encroach on the tiny parcel upon which the crumbling brick building stands and IUPUI's five-story School of Informatics and Computing, where the authors work, looms across the street.

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For the past three years, Copeland worked closely with Olivia McGee-Lockhart, the Bethel AME Church of Indianapolis' Keeper of History, church archivist and historian. Their common goal is to preserve and make accessible the church's archive dating back to the 1850s. The oldest items in the archive include hand written journals, letters, and other evidence that the church was a station on the underground railroad.

Given the social and economic influences in downtown Indianapolis, Bethel's membership has dwindled, and the majority of its parishioners are now elderly. Over time, the church building suffered physically and with increasingly limited resources repairs became unlikely. Selling the building and relocating the church became the best option for sustaining the 180-year-old congregation. The church was sold for several million dollars in the fall 2016 and will become a hotel in the near future. Moving forward, the congregation is already building a new church in another part of the city. The 3D virtual representation of the church's sanctuary is now a significant part of local history documentation, perhaps more importantly, it allows the cultural heritage of this community to remain accessible in a "tangible" form to be celebrated, learned from, connected to, shared with others, and passed on to future generations.

### **3 Courses used in the Creation and Preservation of Virtual Bethel**

N441|3D Production (undergraduate course in the Media Arts and Science Program) is a class that allows students to work as a group and emulates the collaborative efforts found in the media and animation industry. N441 course was chosen, because other courses in the program culminate in N441. For the first time MAS students work in independent teams to solve a problem too large for one individual. The Virtual Bethel project focused on the creation of high-end immersive environments made for virtual reality. Team members demonstrate mastery of narrative, 3D modeling, texturing, lighting, effects, game development and interaction skills culminating in a final team project. Other topics include planning, pre-production, production, post-production and publication of the collaborative for public use.

S582 Digital Preservation (graduate course in the Library and Information Science Program) introduces approaches for preserving digitized and born-digital information (text, images, data, and audiovisual information) to support long-term access and reuse. Topics include: challenges of long-term digital preservation and curation; media and format obsolescence and degradation; integrity and authenticity; appraisal and selection for preservation; formats and strategies for preservation; preservation metadata; risk management; information technologies that are relevant to the digital curation lifecycle; and establishment of trustworthy digital repositories. The Virtual Bethel project files used to create the VR environment served as a case study for the spring 2017 inaugural offering of the course. Students worked to apply course readings to assess the project files and propose arrangement, description, and preservation approaches. Through the development of a new course based on applied practices to an on-going and real-life preservation need, we were able to evaluate this petrological approach for teaching digital preservation.

### **4 Research Questions**

Interest in digital humanities research is increasing on our campus as on many other campuses. This project has received a great deal of attention and excitement, even making the local news. With increasing levels of interest came increasing requests to partner on other meaningful and worthwhile projects. The first phase of this project, the recreation of the sanctuary, was completed using the school's resources without any extra funding; We realized quickly that without additional funding to support these new requests we were at capacity. A critical question emerged: What information, regarding expertise, time, and infrastructure, must be communicated to potential funders, collaborators, and those interested in undertaking this type of work/instruction? Technology aside, defining the cost of skills acquisition for content creation as well as curriculum development is essential to scaling up production and exploring historical and cultural contexts within emerging media. We need to find ways to make the invisible labor and especially the investment of time in skills acquisition interpretable. As yet, there is no research that addresses this problem of how to accommodate this acquisition in higher education settings. Although the problem has been highlighted in the professional discussions [1-3]. We've come to understand just how time, technology and skill intensive these types of projects are. By exploring the skills and technology needed as well as the costs and student experiences, we are able to better communicate the needs of these projects to potential funders and collaborators.

#### **4.1 What are the skills needed by students in these courses?**

N441 | 3D Production

- Animation specialization - 6 or more courses in 3D Specialization

- 3D Modeling
- 3D Texturing, Shading, Lighting
- 3D Rigging and Animation
- 3D Lighting and Rendering
- Imaging, Digital Preservation Pipeline
- Virtual Reality Interaction Theory
- Game Development

#### S582 | Digital Preservation

- Intellectual curiosity and analytical thinking
- Background in archival theory and practice
- Experience with/exposure to managing digital objects and collections in a library or archive
- Familiarity with description: metadata, cataloging, creation of finding aids or other descriptive products that aid discovery and management of information resources
- Comfort with technology: the willingness to experiment with and troubleshoot open source tools
- Information architecture and database design basic literacy (e.g. some exposure to xml)

### 4.2 What technology is needed to support these courses?

#### N441 | 3D Production

##### Software

- Pixologic Zbrush (\$800)
- Autodesk Maya (0 - \$3500) (based upon student or professional licensing)
- Substance Painter and Designer (\$100/month for non students)
- Unity or Unreal Development Kit (Game Engine) free with various equity share models upon publishing of experience.

##### Hardware

- Camera for Reference (\$500 and up)
- Virtual Reality Development Kit (\$600/unit) + \$2500 for mobile laptop unit & backpack)
- Computing for Development (\$2,000.00 and up per developer/artist)

##### Space

- 600sq/ft lab with 43 PC's including Cintiq Displays for Digital Artists
  - PC's \$2500/piece: 32gb RAM, Quadcore i7 Processors, NVIDIA GeForce GTX 780 Ti
  - Cintiqs \$\$2000/piece

#### S582 | Digital Preservation

##### Software/Storage Space

- Course management platform (freely available through university)
- Approximately 50GB of cloud storage (freely available through university)
- Digital preservation tools used in class are open source and easily downloaded ([http://coptr.digipres.org/Main\\_Page](http://coptr.digipres.org/Main_Page))
- DSpace (open source) was installed by IT staff on existing departmental server for the class, but not used (<https://wiki.duraspace.org/display/DSDOC6x/Installing+DSpace>)

##### Hardware

- Students own PCs, meeting minimum technology requirements needed for the fully online MLS program (e.g. current OS, updated browsers, standard office suite software applications)

### 4.3 What are the costs associated with these courses?

#### N441 | 3D Production

- Student Labor - 560 - 1120 hours student labor - between \$7,000 and \$14,000
- Faculty Labor - 96-120 hours faculty labor - \$12,000
- Technology - \$17,800 (academic rate); \$36,000+ (commercial rate)
- Lidar Scanning Service \$1500

#### S582 | Digital Preservation

- Faculty Labor -
  - Course design and instruction around a complex collection in a developing area of digital preservation lacking a strong body of practice
- Technology - ca. \$25 for 100GB

#### 4.4 What are students experiences of these courses?

N441| 3D Production: Students are overly positive and wish to have worked on team collaborations earlier in their college career. Student prior technical proficiencies create opportunities to introduce emerging technologies such as virtual reality with relative ease. Students do not feel intimidated or reluctant to take on challenges such as the creation of Virtual Bethel. Recent feedback suggests that a similar course integrating freshmen, sophomore, junior, senior, and graduate students, regardless of technical proficiencies, would yield much stronger student stories earlier in the bachelor's experience and a more rounded professional, post-graduation.

Because the students had high levels of technical fluency, the students faced challenges related to working in a team-based production environment and could extend their technical expertise through the application of it. This student's feedback illustrates this point, "I learned more about substance painter which I really enjoyed. I also learned how to make clown maps. I also learned about this amazing church that was modeled in this class. Another thing I learned is that people don't try as hard as others and that the workflow is not fair for some." And another student shared: "This project taught me some things that I think will be of benefit to the future works I do involving team leading. I learned there has to be a balance in how hard you are on your team....I also learned some things regarding the 3D production pipeline....understanding scale in the various 3D applications, and how to take models from a program like Maya into a game engine and set dress the scene with those assets."

S582 | Digital Preservation: Immediately following the end of the course in the May of 2017, the students were given a survey to gather input regarding their experience of the course. Throughout the course, there were signs that most of the students were not prepared for the level of technology fluency needed. Course prerequisites have been added as a result. These comments support the need for more scaffolds to be in place: "This is an excellent class and .... did a great job teaching it. However, I really believe this class needs several pre-requisites. I took it too early in my LIS journey." and "just completing the class and having all of the readings available and projects to look back on has helped...however, I had zero previous knowledge or experience!"

Framing the course around a real-world problem with no one or clear answer was met with mixed results. One student indicated it "gave me anxiety" another said "it was all very overwhelming" and another simply stated, "crazy times." Another student was much more positive, "I really enjoyed this approach. It made my work feel more meaningful and made it easier for me to connect the theoretical information with real life through the Bethel example." This comment echoes the above sentiment great class but almost too challenging, "I appreciated that [the instructor] realized this class was particularly challenging and encouraged us to keep pushing through. I feel like I learned a lot, and I am glad to have signed up."

## 5. Discussion

Students with greater knowledge of and experience with technology were more successful and more satisfied than those with less: N441's student had prior extensive technology coursework and were more positive about the course. Whereas in S582, students were less technically sophisticated and were less satisfied. In the future, S582 will have required prerequisites. Additionally the course will be divided into two parts: the first course will cover relevant technology and foundational content and not until the second course will students be given a case study to apply the knowledge gained in the first course. With regards to virtual reality production, the costs for both skilled labor and technology are extensive. Ideally collaborative relationships will be formed with other departments on campus and other universities who do not have the technology and expertise to build virtual environments but can provide access to diverse domains that present new challenges to explore as virtual reality creation and preservation evolves.

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