Protecting cultural heritage through augmented reality immersion of historic sites

Rob Williams
GEOG 596A Capstone Proposal
Spring 2 2019
Presentation outline

- Background and Situation
- Motivation and Purpose
- Project Goals and Objectives
- Working hypotheses
- Proposed Methodology
- Project Timeline
- Anticipated Results
- Further development
Background - Context

• The National Park Service (NPS) sets U.S. standards and guidelines for communities’ cultural resources
• “Above ground” historic properties’ practices are:
  • Preserve
  • Rehabilitate
  • Restore
  • Reconstruct
• “Below ground” archaeological practices are:
  • Curation
  • Conserve
  • Manage Collections
Background: Problem in Cultural Heritage and Historic Preservation

• Cultural Heritage policy and practices seek to protect and preserve historic sites*
  • “Above ground” – preservation of extant structures
  • “Below ground” – archaeology

• Public support targets heritage assets that can be seen, but a community’s heritage is larger
  • Structures
  • Archaeological sites

• A community’s cultural heritage rests in a broader context that is invisible – e.g. hidden by demolition

* Interview, Regional Director, PA Historical & Museum Commission
Motivation

• Local preservation groups have the practices to protect above-ground extant structures
  • Distributed local authority

• Specialize archaeologists provide the skills to protect and curate below-ground sites
  • Professionalized authority

Preservationists have no means to manage vanished, above-ground historic structures

* U.S. standards and guidelines set by National Park Service (NPS)
Subject historic structure - Paoli Inn 1769-1899

Paoli Inn 1888

Tredyffrin Easttown Historical Society Image Collection
Subject historic structure - Paoli Inn 1769-1899

Lucy Sampson Photo 1899 TEHS

Tredyffrin Easttown Historical Society Image Collection
Project Goals and Objectives

• Purpose
  • Enrich the public’s awareness and appreciation of local cultural heritage by viewing invisible historic structures using spatial augmented reality

• Goal
  • Demonstrate and evaluate AR immersion of a vanished historic building

• Objectives
  • Model a historic building from local map & text archives
  • 3D geo-locate the model into the accurate GIS environ
  • Assess the 3D accuracy – 2D plane, z-plane DEM
  • AR visualize the modeled and located building in real space
  • Evaluate the user experience of historical preservationists
Methods - Virtual & Augmented Capabilities
PSU Geography Dept

Georeferenced historic large scale maps
PSU Library

Sketch Up Overlay on Ortho Image
GEOG 497 3D & Virtual Reality

Geolocated Augmented Reality PSU Obelisk
ChronPhronesis Lab AR
Project Workflow

**QGIS**
- Area Ortho Image
- Area DEM
- Historical Map
  - Geo-reference Map Overlay
  - Terrain Raster
  - Computed Accuracy Assessment
  - Field Accuracy Assessment
  - UX Field Test

**SketchUp / Blender /**
- Structure Photos
- Text Description
  - 3D Model
  - Geo-reference Model
  - AR App

**Data Source**
**Process**
**Test & Verification**

*Process steps: GEOG 497B 3D Modeling and Virtual Reality*  
*Spring 2016*
## Data sources

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<th>Historic Map</th>
<th>Images</th>
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Paoli Inn
Pennsylvania Railroad map

Atlas of Properties Along the Pennsylvania R.R from Overbrook to Malvern Station, 1887, Plate 29, Athenaeum of Philadelphia
The house at the time of the Revolution was a small unpretentious two-story affair, with small windows and low ceilings and, as near as can now be determined after the lapse of one hundred and thirty-five years, covered a space of about 42 x 30 feet. Remnants of the original building can still be seen. The house when built faced the ancient road leading from the Yellow Springs to Newtown Square and known as the Darby road. It is also said to have been a former Indian trail. This road crossed the

3rd structure, front – image record

Paoli Footprint
1st 1769 - 1260 sq ft
2nd 1778 - 810 sq ft
3rd 1812 - 3078 sq ft

5148 sq ft
ground floor

Paoli Inn – 2019 site location
Paoli Inn – ground-level 1886 & 2019

Working hypotheses

• Preservation will be aided by making visible in-situ vanished historic structures and sites
  • Representative models can be viewed in AR space
  • Workflow of modeling and GIS-locating of historic structures can produce a 3D walk-around capability

• Local preservationists will positively rate the AR experience, and AR’s utility for preservation work
Accuracy Assessments

• Modeled accuracy
  • Ortho image – x-y-plane
  • DEM – z-plane
  • Building Model – scaled from images and historic text

• Geospatial accuracy
  • GPS-mobile device
  • x-y location
  • z plane
    • note terrain and grade significantly changed since 1899

• User experience - visual referencing
  • Scaling, perspective
  • Ground level interface
  • Immersion quality and impact
Time line

- Proposal May 1
- GIS archaeology course June 6-21, Spain
- GIS and SketchUp model July 31
- Deploy into AR environment Sept 15
- User testing and analysis Oct 15
- Write up Nov 30
- Conference TBD 1Q 2020
Expected Results

1. Primary
   • On-location AR viewing of the Paoli Inn. Siting accuracy will be evaluated quantitatively.
   • User experience report based on 5-10 preservationists trial of the AR app. Results from a user survey or focus group event.
   • Comprehensive workflow documentation to produce the model and AR environment.
   • Presentation or paper to a national conference. Preference will be at a historic preservation event.

2. Secondary
   • Accuracy evaluation of the model in the AR space
Conference presentation - tbd

• Historic Preservation
  • National Trust for Historic Preservation – Oct 10-12
  • Preservation PA Statewide Conference on Heritage – June
  • Int’l Conference on Digital Heritage – Nov 18-19 London

• Geography
  • Assoc of American Geographers

Note: this listing is incomplete
Further development

- A summary of extending the research will be done
  - Efficiency improvements in the workflow
  - “Better practices” in selecting data and sources, e.g. minimum thresholds to achieve a viable AR experience, historic maps and texts, siting the AR model in 3-space, UX tips for viewers
- If observed, lessons on how in-situ 3D viewing can help with digital cultural heritage and historic preservation will be recored.
User Experience (UX) Evaluation

• Survey and/or focus group
• 5-10 people – local preservationists & historians
• Questions concerning:
  • Authenticity of experience
  • Level of visual detail – repetitive or exacting
  • Visual rendering – e.g. shadows, etc.
  • Utility – sufficient for aiding preservation objectives

Unknown:
- How to produce, administer, compile and verify an UX assessment