

Protecting cultural heritage  
through  
augmented reality immersion  
of historic sites

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GEOG 596A Capstone Proposal

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# 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

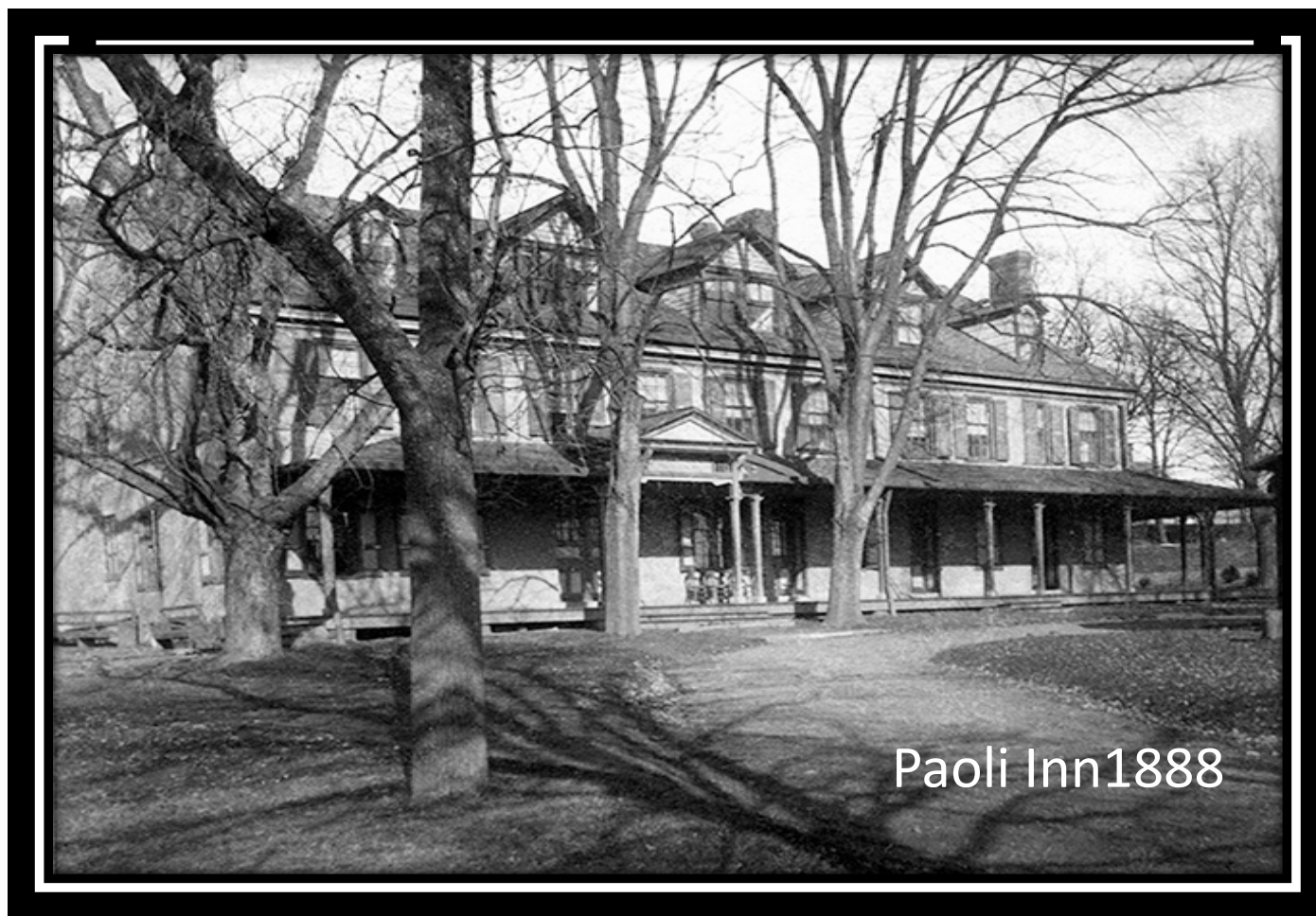
## Cultural Heritage Assets

Above Ground	
<u>Extant structures*</u> <ul style="list-style-type: none"><li>• Preserve</li><li>• Rehabilitate</li><li>• Restore</li><li>• Reconstruct</li></ul>	<u>Demolished structures</u> <ul style="list-style-type: none"><li>• Geo-locate</li><li>• Reconstitute</li><li>• Resurrect</li><li>• Visualize</li></ul>
Below Ground	
<u>Buried sites and ruins *</u> <ul style="list-style-type: none"><li>• Curation</li><li>• Conserve</li><li>• Manage Collections</li></ul>	

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



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Lucy Sampson Photo 1899 TEHS

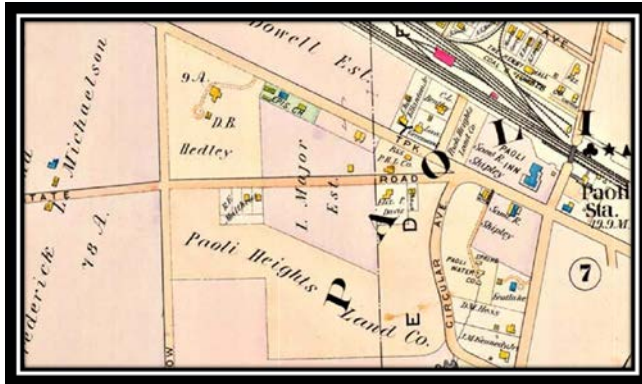
# Project Goals and Objectives

- 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

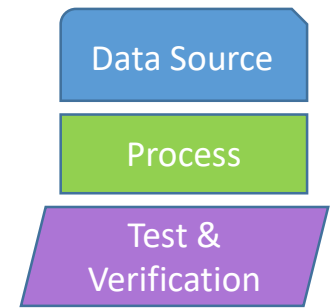


Sketch Up Overlay on Ortho Image  
GEOG 497 3D & Virtual Reality

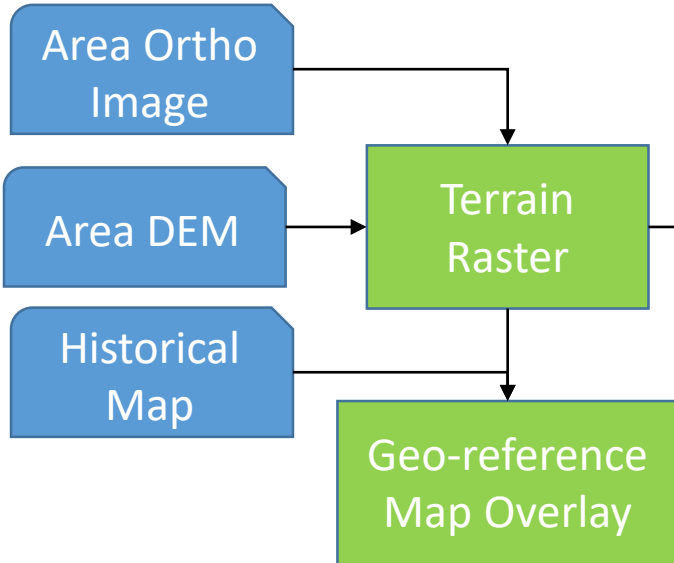


Geolocated Augmented Reality PSU Obelisk  
ChronPhronesis Lab AR

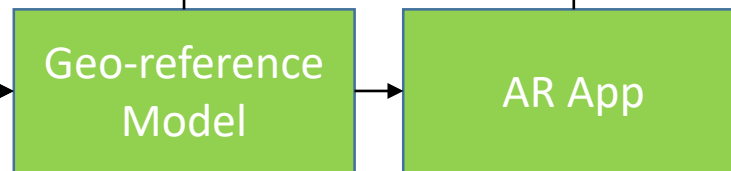
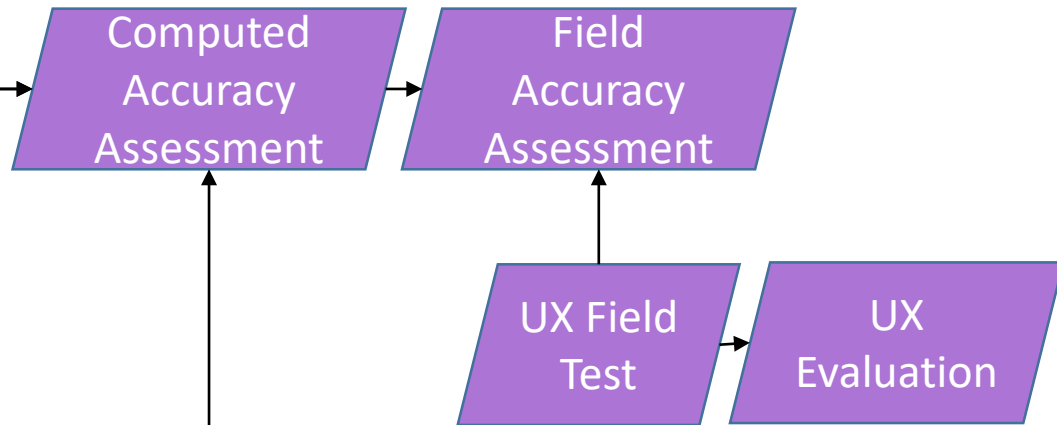
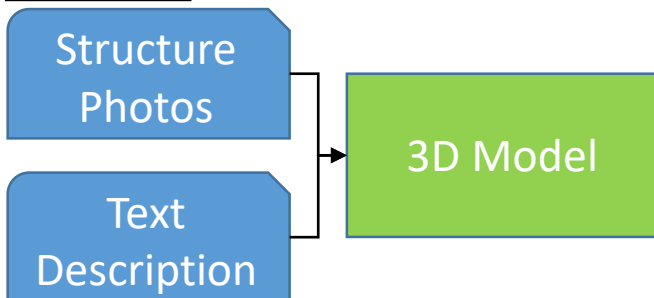
# Project Workflow



## QGIS



## SketchUp / Blender /



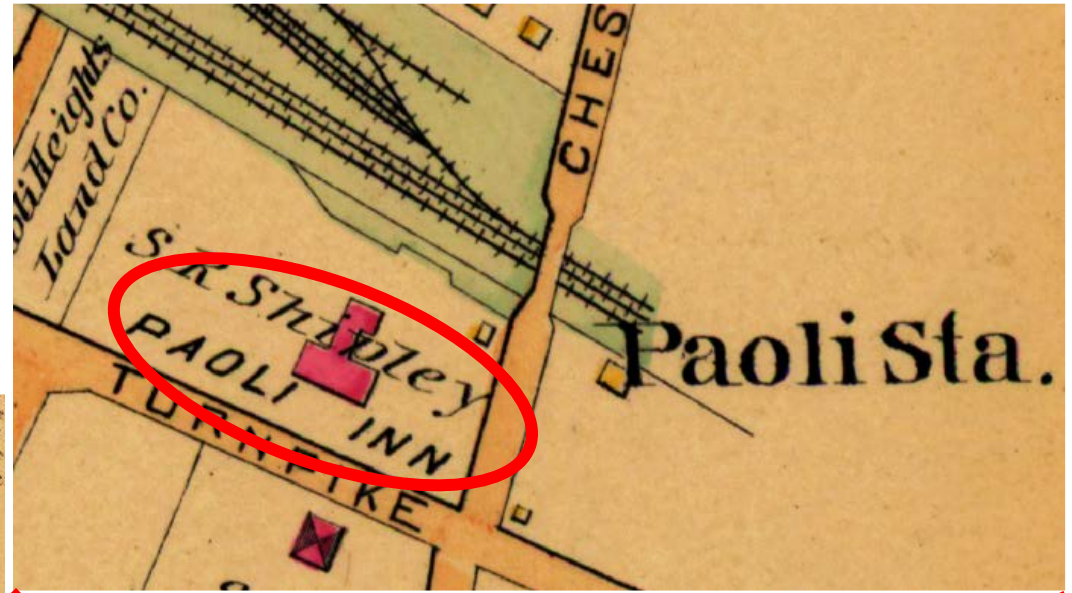
**Android/iOS ?**  
**SW Platform ?**

# Data sources

Data Type		
Historic Map	<ul style="list-style-type: none"><li>• 1777 Battle of Brandywine map</li><li>• 1883 Breau land ownership map</li><li>• 1897 &amp; 1912 PA RR Mueller maps</li></ul>	<ul style="list-style-type: none"><li>• PA Chester Co</li><li>• Greater Phila. Geo-History Network</li></ul>
Images	<ul style="list-style-type: none"><li>• Paoli Inn photos – late 1890s</li></ul>	<ul style="list-style-type: none"><li>• Tredyffrin Easttown Historical Society image repository</li></ul>
Text record	<ul style="list-style-type: none"><li>• “The General Paoli Inn” in <u>The wayside inns on the Lancaster roadside between Philadelphia and Lancaster</u>, by Julius F. Sachse, 1915.</li></ul>	<ul style="list-style-type: none"><li>• Hathi Trust Digital Library / Library of Congress</li></ul>
DEM		<ul style="list-style-type: none"><li>• PASDA</li></ul>
Ortho		<ul style="list-style-type: none"><li>• PASDA</li></ul>

# Paoli Inn

Pennsylvania Railroad map



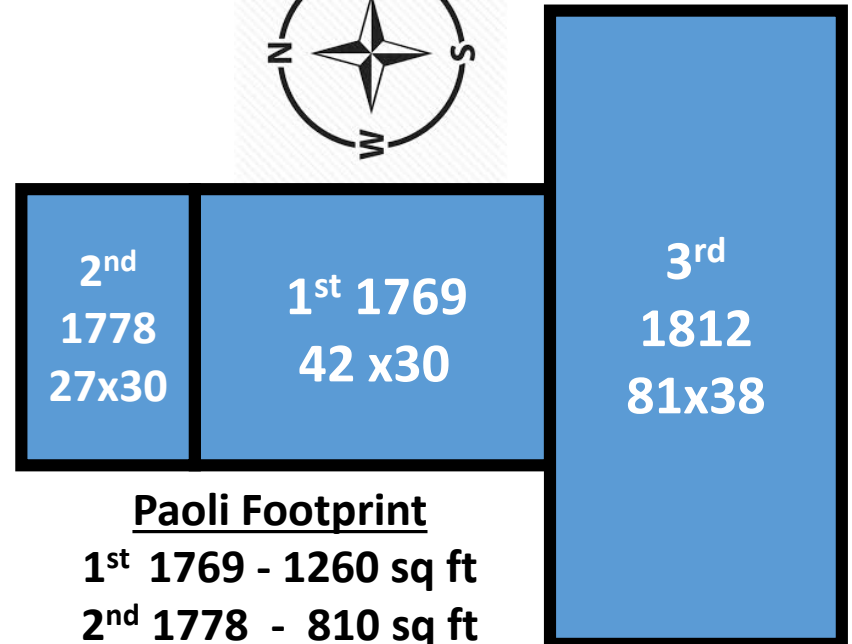
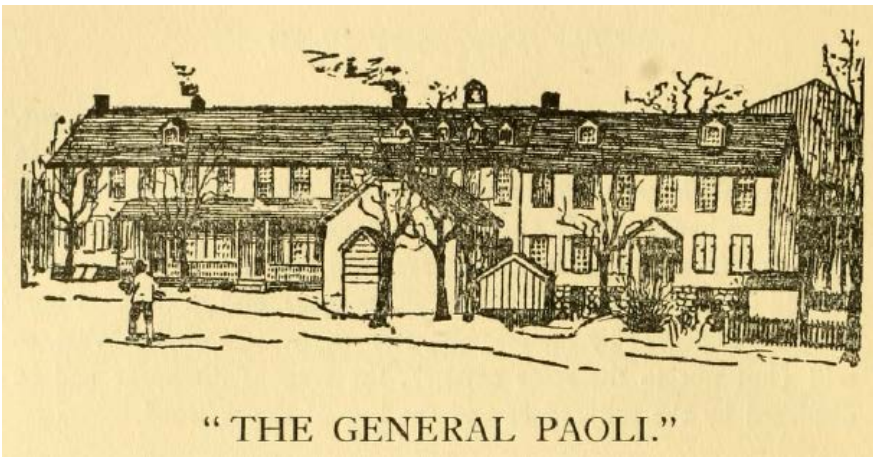
Atlas of Properties Along the Pennsylvania R.R. from Overbrook to Malvern Station, 1887, Plate 29, Athenaeum of Philadelphia

# Paoli Inn - Footprint

## Original foot print – text record

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

## 3<sup>rd</sup> structure, front – image record



### Paoli Footprint

1<sup>st</sup> 1769 - 1260 sq ft

2<sup>nd</sup> 1778 - 810 sq ft

3<sup>rd</sup> 1812 - 3078 sq ft

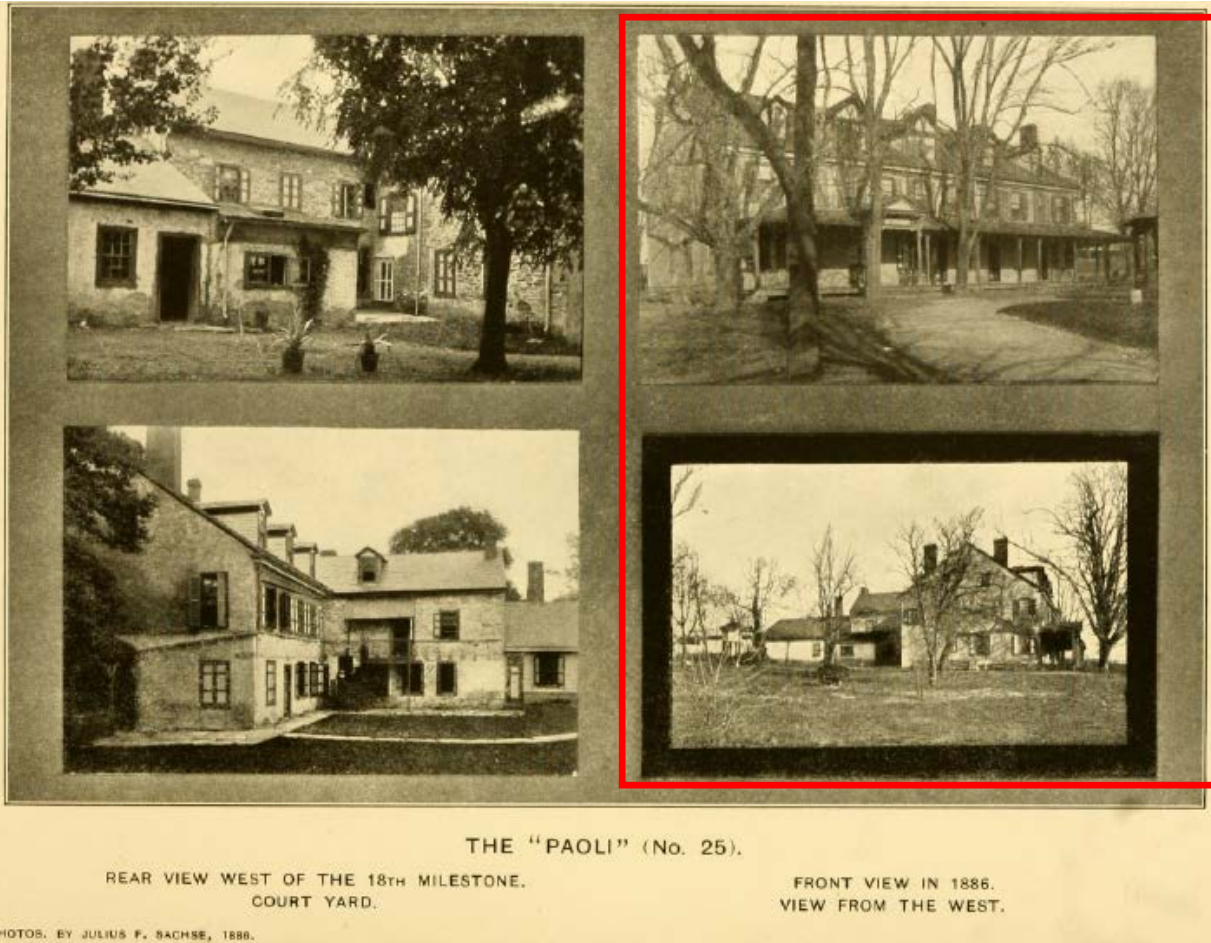
5148 sq ft  
ground floor

The wayside inns on the Lancaster roadside between Philadelphia and Lancaster,  
Julius F. Sachse, 2<sup>nd</sup> ed., 1915.

# Paoli Inn – 2019 site location



# Paoli Inn – ground-level 1886 & 2019



The wayside inns on the Lancaster roadside between Philadelphia and Lancaster,  
Julius F. Sachse, 2<sup>nd</sup> ed., 1915.

# 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