Honors Thesis Proposal

For

Comparative Headstone Analysis and Digital Curation of Cemeteries in Orange County, Florida

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Introduction

Similar to many aspects of nature, death is an inevitable life event that can occur at any moment. The life that an individual has left behind can sometimes be embodied by the commemoration of their death. Cemeteries have always provided cultural contexts and served as historical repositories that can capture the intimate details of individuals from the past. The carved details of the headstone can express a symbolic representation of the deceased such as religious beliefs surrounding death and resurrection, as well as socioeconomic status (Deetz, 1996). Furthermore, they serve as a temporal reference to specific time periods of an individual's existence and perspectives of that time (Meyer, 1992). Headstones are an aspect of cemeteries that withhold significant information that can provide insight to temporal references to headstone artwork, verses or epitaphs, relationships, and so forth (Carmack, 2002; Meyer 1992). Ergo, these headstones can serve as artifacts, some of which are well maintained while others are left in poor conditions that encourage destruction. Some of the risk factors that headstones can be exposed to are coastal erosion, vandalism, lack of maintenance and abandonment (Meyers and Schultz, 2016).

Despite being an exemplary representation of culture, historic cemeteries have received poor documentation and representation throughout literature. Genealogical groups and individuals seeking to make personal family connections mostly focus on headstones without much analysis to offer. Most of the literature encountered has presented methods on the location of family graves and plots, along with distinctive characteristics that can aid with burial identification (Baugher and Veit 2014; Carmack 2002; Meyer 1992). Additionally, the type of gravestone representation in literature can be categorized by lengthy descriptions and 2D images. Although these representations can be helpful, there are current digital documentation methods such as photogrammetry that are being used throughout archaeology for similar purposes (McCarthy, 2014).

Lack of Research in Florida

Literature that is currently circulating mainly focuses on the northeastern region of the United States. Much of the research on grave markers and graveyards can be found completed in states such as New England, New Jersey, and New York (Meyer, 1992; Little, 1998). However, some efforts have been made to focus research on the southern region of the United States. Diana Combs was the first to publish a southern gravestone study, *Early Gravestone Art in Georgia and South Carolina* (Little, 1998). These efforts have continued to stretch further south including states like Texas (Jordan, 1982) and most recently a study conducted in Florida that focused on grave marker typology and headstone attributes (Meyers and Schultz, 2016).

Research Purpose

The goal of this research is to establish a typology of headstones within a sample of historic cemeteries located in Central Florida. The geographical location of the sample is concentrated in central Florida in Orange County, (See Figure 1) the time frame ranges from pioneer to present. Using the headstone typology developed by Meyers and Schultz as a guide, headstone attributes that will be focused on are the stone type, shape, time period, and sex of the individual (2016). In addition to establishing a headstone typology, the development of best practices for photogrammetry techniques based on the creation of 3D models for each headstone type will be incorporated in the research project. The foci will include areas of photogrammetry that involve rig set-up, data acquisition, and software workflow details. Finally, the development of best practices for digital curation of the headstones from this sample will be established. There are various avenues available for digital curation of archaeological materials available and those methods will be explored in order to determine which will provide the best form of public accessibility and simplify curation workflow. Deetz (1996), stresses the importance of accurate descriptions of artifacts. Due to their cultural significance in providing intimate details about the past, headstones serve as an artifact that require analysis. Headstone analysis can aid in the refinement of seriation for the purpose of studying temporal trends of grave marker imagery, symbology, and styles (Deetz, 1996). Knowing that headstone analysis hinges on imagery, the inclusion of a photogrammetry application can aid with an accurate visual representation of headstones. Additionally, these efforts can be introduced to local organizations such as the Florida Public Archaeology Network to incorporate a digital cultural heritage aspect to their projects.

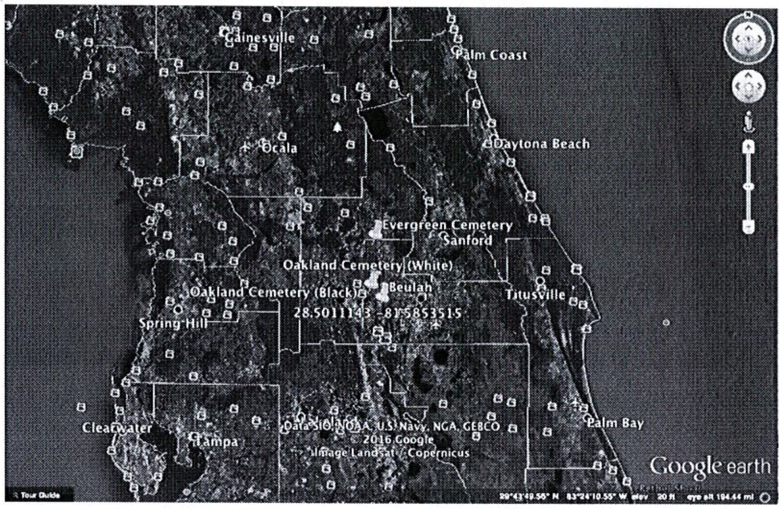

Fig. 1 –
Google Earth map with sample of historic Orange County Cemeteries.

Background – Photogrammetry and Digital Curation

Photogrammetry

Photogrammetry can be defined as the creation of a 3D model from 2D images taken at various angles of the same object (Azzam, 2017). Historically, photogrammetry has been around for over a 100 years, photogrammetry has been used in a wide array of professions; ranging from a military application in World War II for the creation of invasion maps to the construction of topographic maps of the moon surface by NASA during the Apollo missions (Blizard, 2014). In regards to archaeology, it's background was mostly found in contract-led projects due to the short processing period but was still restricted in yielding detail which is why it wasn't extremely popular in the early 2000s (McCarthy, 2014). However, this opinion soon changed once improvements to the software began to shift the production quality of photogrammetry 3D models. The digital technique's first recorded application in archaeology was in the analysis of aerial photos to determine the accuracy of aerial mapping of archaeological features such as crop marks (McCarthy, 2014). Its occurrence in archaeology has increased with its applications currently including the documentation of petroglyphs in various regions, rock art sites of Northern Europe, and cultural heritage projects such as the documentation of Scottish grave markers (McCarthy, 2014; Ortiz et al. 2010).

The use of photogrammetry has its advantages and disadvantages, which have influenced its usage in the archaeological community as a tool for analysis. Some of the main reasons as to why this method is used can be discovered in its financial modesty and the software's interface being user-friendly. With the increased development of photogrammetry software, not much equipment is needed to fabricate a 3D model. In comparison with other 3D rendering methods such as laser scanners, a photogrammetry-based approach will cost significantly less, upwards of tens of thousands of dollars (Church, 2012). For starters, most of the photogrammetry programs can cost as low $30/month or can be on the higher end and cost 7,960/year (Azzam, 2017). If the price isn't a determining factor for choosing software then the variations in: user manipulation of data, software interface, and data input limit would be other factors to take into consideration. In addition to the low cost of the software, supplementary equipment purchases shouldn't hinder the photogrammetry process. For example, camera brand and price are not crucial factors to 3D model building as long as it doesn't affect the quality of the images taken of the object. Suggested cameras for current photogrammetry projects are the Nikon 810 and Canon 5D due to their ability to produce the sharpest images (Azzam, 2017). Moreover, the general consensus is that the program is easy to learn and produces fairly quick and desirable results (Douglas, Lin, Chodoronek, 2015; Ortiz et al. 2010). Depending on which program is used, they each provide a unique experience with similar results. Some programs such, as AgiSoft Photoscan Pro doesn't restrict the amount of photos uploaded into the program whereas others do (Azzam, 2017). Software logistics should be determined based on the research questions.

The disadvantages of photogrammetry-based documentation can be discovered in the workflow, particularly in the areas of data acquisition. Before photos can be taken, the object being documented needs an adequate setting and proper rigging to ensure that image quality is maintained during the photo-taking session (Porter, Roussel, and Soressi, 2016). Rigging can be determined based on the object needing documentation and can range from a simple black velvet background and extra lighting or requires an additional materials such as a turntable, tripod, and so forth. Image quality can greatly affect how the models are generated and the details they produce. It has been noted that poor quality images produce highly variable "noisy" mesh (Magnani, Douglas, and Porter, 2016).

Digital Curation

Due to the integration of digital methodology in the archaeological community, there has been an increased effort to make discoveries and field data digitally accessible to the public. Digital databases have been incorporated since 1984, with the first databases being established by archaeologists at Tall al-'Umayri (Vincent, Kuester, and Thomas, 2014). Like any foundational technology, it was coarse software that required a specialist to operate it. But as time continued on, so did the development of the database. Digital curation soon took a change in direction and has now recently focused on developing a simpler workflow and dissemination process. There are programs available such as *OpenDig*, which provides users with a framework that consists of a mobile application, an in-field lab server, and a web function (Vincent, Kuester, and Thomas, 2014). This option encourages that the curation process starts in the field with as much raw data input as possible. Additionally, there are programs such as *Kurator* that incorporate known software platforms such as Google cloud services to simplify workflow steps and data distribution (Dou et al. 2012). These options provide archaeologists with the tools for accurate documentation of data and dissemination to a larger audience.

Methodology and Cemetery Sample

Sample Size

For the scope of this project sample size was based on a total number of graves comparable to Meyers and Schultz research project (2016). In addition to a similarity in total grave numbers, concentration of cemetery location within Orange County, Florida was a consideration. The sample will include four, potentially five historic cemeteries located in Orange County, Florida. The cemeteries being used for this project are two Oakland Cemeteries (African American and White), Evergreen Cemetery, Gotha Cemetery, and Beulah Cemetery. The approximate headstone amount between all five cemeteries is 1,100.

Table. 1 – The cemetery information derived from numerous online sources.

Cemetery	Year Established	Time Period	Approx. # of Graves	Location	Cemetery Population
Oakland	1890	Pioneer-Present	200	Oakland, FL	White
Oakland	1926	Mid-20th-Present	300	Oakland, FL	African American
Evergreen	1890	1890-Possible Present	300	Zellwood, FL	Assumed White
Gotha	1890	1898-Present	100	Gotha, FL	White/German Settlers
Beulah	1866	Pioneer-Present	200	Ocoee, FL	White

Time Period

Since temporal data will be accessed during data acquisition, a time period will need to be established for the headstones of the sample. Within the sample size, an overall time period has been established ranging from the oldest dates of interment during the pioneer period to up present burials. Depending on the number of burials categorized in each time period, a set interval of years will be established once data is collected. A previous study used 20-year increments, which may prove to be a suitable for placing the number of samples in their adequate time period (Meyers and Schultz, 2016).

Data Collection

Data collection will include recording attributes for each grave marker. The decedent's birth and death date, age at death, marker type, marker material, and iconographic images will be documented. Carmack (2002) provides an excellent reference for the type of markers used during specific temporal periods. A similar headstone typology was used in Meyer and Schultz's project and will serve as a guide for this project (2016). With the broad range in time between all the cemeteries, various stone typologies of headstones are expected to be encountered and documented. These typologies include wood or fieldstones (before 1650s/African American cemeteries), brown sandstone or limestone (1660s – 1850s), slate (1800s – 1850s), marble (1830s – 1880s), soft gray granite or cast-metal markers (1880s – 1910s), and granite (1920s – present) (Carmack, 2002; Meyers and Schultz, 2016). In addition to stone typology, headstone shape will also be documented. Classifications that are already established and that will be used are beveled, cube, cross, ground, ledger, military, slant, upright, t-bar, and vaults. (See figure 2 & 3) Iconographic imagery will be documented and used to determine the sex of the deceased if the scripts on the headstones are illegible. A data collection form created in *Google Forms* for each headstone will be used to document attributes. (See Appendix 1)

Fig.2 – Temporary Marker.

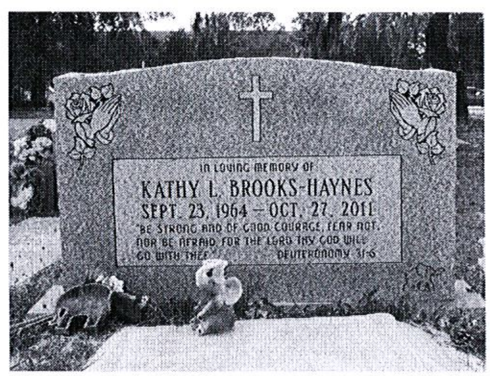

Fig. 3 – Rectangular Marker.

Established methods for recording the data are: taking 2D images of the headstones and the transcription of the information available on the stone (Carmack, 2002; Little 1998). For this research project, photographs will be an integral aspect of data collection and digital documentation. Several typologies of headstones from all of the cemeteries mentioned will be collected via photography to be later processed in photogrammetry software. To generate the desired high-quality 3D model, estimate 100 to 250 photos will be taken of each headstone. This number will be subject to variability due to software processing. At this stage of data collection, proper rig setup will need to be established at the cemetery to ensure that the images used for processing are at their highest quality. Possible rig accessories may include a large black velvet background to cover unnecessary grave objects, tripod, scale, fixed lens, monopod, remote and north arrow.

Data Processing and Digital Curation

Once the data has been collected, the information will be arranged in various graphs and charts to display a visual representation of headstone typology within the five cemeteries. Images will be used to show what headstone characteristics can be distinguished with 2D imagery and also be compared to what is rendered in subsequent 3D models. Photogrammetry software has not been established, but the University of Central Florida has an educational license with Agisoft Photoscan Pro. The development of a standardized workflow will be the next course of action after the images have been sorted to their respective cemeteries and headstone typology. Photogrammetry workflow will be dismantled into categories such as masking and building mesh, which allow for the user to alter the images and the quality of the 3D modeling processing (Azzam, 2017; Benoit, 2016). Furthermore, once a standard workflow has been established and the 3D models are exhibiting high-quality results; a file type will also be selected that displays the 3D models quality similar to what is in the photogrammetry software. The models can be exported via various file types such as 3D PDF, TIFF, JPEG, and can even be shared via email (Douglas, Lin, and Chodoronek, 2015). The determination of file type will also be contingent on which digital curation method is selected.

The final step of this research project is to determine the best practices of digital curation. There are a number of responsibilities to consider when using a digital archaeological record. Some areas that will need to be reflected on will be the curation workflow and type of platform used for the research project. Curation workflows have proven to be problematic in the past. Determining the types of digital data (2D and 3D) that comprise each headstone is a key aspect of digital curation of cemeteries. If the inclusion of metadata such as raw, unprocessed increments doesn't compromise the simplicity of the workflow then it will be considered for inclusion. Additionally, the type of metadata will be determined such as the necessity of including algorithms, meshing parameters, and so forth. In addition to data inclusion, the curation platform will also be established. There are several curation options available for archaeological records and 3D models. Some options that simplify the curation process are *ArchaeoSTOR* and *OpenDig*, which are software packages that provide the user with features such as visualization settings for analysis and allows for the generation of data in the field using a remote server (Gidding, Matsui, Levy, DeFanti, and Kuester, 2013; Vincent, Kuester, and Levy, 2014). In addition to software packages, there are also online hosting sites such as *Sketchfab*, which allow for public display (Douglas, Lin, and Chodoronek, 2015).

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Appendix 1: Data Collection Form

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Appendix 1: Data Collection Form

Data Collection Form

HIM Thesis - Headstone Analysis

Cemetery

Your answer

Last name, First Name

Your answer

Birth Date

Date

Death Date

Date

Width in Inches

Your answer

Height in Inches

Your answer

Single-Multi Grave or Multi Grave

Single-Multi Grave

Multi Grave

Marker Type 1

Choose

Maker Type 1 Notes

Your answer

Marker Type 2

Choose

Marker Type 2 Notes

Your answer

Marker Material 1
Choose

Marker Material 2
Choose

Iconography 1

Your answer

Iconography 1 Notes
Your answer

Iconography 2

Your answer

Iconography 2 Notes
Your answer

Image Number and Field Notes
Your answer

SUBMIT

Never submit passwords through Google Forms.