A143 The Incorporation of 3D Photogrammetry and Geophysics in the Recovery of a Mass Grave: Six Years of Experiential Learning

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The goal of this presentation is to provide crime scene investigators and physical anthropologists exposure to innovative field techniques (incorporating 3D photographic survey and geophysical methods) to increase success in identifying and recovering mass graves. In addition to a review of the methods and processes involved, this presentation will provide tips and tricks for minimizing costs and for working in remote locations.

This presentation will impact the forensic science community by explicating cost-effective and efficient field methods for surveying and documenting mass grave recovery projects. The methods in this presentation have been field tested over several years in an applied setting. 3D survey can be prohibitive in the field for several reasons, but the photogrammetry methods presented here are fast, inexpensive, and simple enough so they do not require specialized field personnel. The geophysical procedures, while still requiring trained personnel, are developed in order to reduce time spent excavating "false positives" and for dealing with difficult subsurface matrices.

The forensic community has seen a steady increase in the use of technology as a means of quickly and accurately documenting crime scenes over the past several decades; however, for the recovery of human remains, timing, conditions, and budgetary constraints often preclude successful use of cutting-edge technology in applied field situations. This research focuses on the application of advanced photographic and geophysical surveys as a practical means to bolster documentation accuracy while still keeping costs to a minimum and reducing the need for specialized personnel onsite. Advances in 3D photogrammetry applications and field methods for geophysics are adapted specifically for the recovery of human remains, and are shown to be particularly useful for mass grave recovery.

This presentation details field- and lab-based processing methodologies that can be implemented for the recovery of human remains in a variety of environments and at various project scales. For this research, experimental graves were surveyed using Ground Penetrating Radar (GPR), soil resistivity, and 3D photogrammetry. Most notably, a planned mass grave was surveyed with geophysical techniques periodically over the course of six and one-half years. Established in May of 2010, the irregular-shaped pit is just under four meters across, and geophysical data were collected beginning two years post-interment, so the usual indicators of clandestine graves on the surface were generally obliterated through natural weathering processes.

The area was additionally surveyed for 3D reconstruction both before and after excavation. 3D reconstruction and photogrammetry methods detailed in this presentation utilize commercial-grade cameras that are inexpensive and do not require specialized photographic skills. Point-and-shoot cameras easily and successfully capture sufficient details for digital measurement of less than 1mm. Even higher levels of precision can be reached with cameras that have macro photography settings. Available commercial software and free and open source software allow quick and easy processing and measuring of digital 3D models. Photorealistic textures are generated that add additional precision and measurable values, such as color and texture. Additionally, the 3D reconstructions provide very compelling digital products that can be explored in Virtual Reality (VR) or Augmented Reality (AR) environments.

The photogrammetry procedures detailed in this presentation can be learned easily, quickly, and, in most cases, do not require any additional equipment or personnel; however, the methods do provide a level of detail and accuracy that is equivalent or surpasses what can be obtained through ground-based laser scanning.

Experimental stations are located at the outdoor Anthropological Research Facility at the University of Tennessee, allowing for the unique examination of human remains in a variety of contexts representative of the natural environment. In addition to providing loci for experimental stations, the facility provides opportunities for student engagement and the training of law enforcement officers, thus providing further insight into how well methodologies can be adopted by these communities and informing pedagogical approaches. This presentation will briefly discuss ways that the aforementioned procedures can be incorporated in an experiential learning environment.

3D Photogrammetry, Geophysics, Excavation

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