A101 The Application of Photogrammetry for Documenting Scenes With Skeletal Remains: Capabilities and Shortcomings for Use in Central Florida

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After attending this presentation, attendees will have a better understanding of the uses of Close Range Photogrammetry (CRP) for documenting the context of various outdoor forensic scenes. This presentation will focus on the differences in accuracy of 3D models containing faux skeletal material in three simulated outdoor forensic scenes.

This presentation will impact the forensic science community by describing how CRP has advantages over traditional photographic methods, as well as how the context and ground surface composition of outdoor forensic scenes can affect the output texture. The CRP models of the three scenes were created using Agisoft® PhotoScan® Professional.

The documentation of outdoor crime scenes with skeletal remains can pose a challenge to law enforcement professionals and forensic anthropologists because various taphonomic processes normally act upon the crime scene to alter and change context. Recent trends in forensic anthropology highlight the importance of applying more rigorous methodological approaches during forensic recoveries that emphasize proper documentation of context in crime scene scenarios.[1] The purpose of this presentation is to introduce photogrammetry methods, which can be invaluable tools in the preservation of contextual information, that were utilized to document three simulated forensic scenarios within the Central Florida pine flatwoods biome.

Photogrammetry is a data collection technique that relies on photographs and specialized software using a Structure-from-Motion (SfM) visual computing algorithm. The SfM software finds points of intersection among a series of images to compute a 3D model. The use of CRP techniques for the output of 3D models offers a novel approach to the collection and presentation of context at outdoor forensic scenes. While the use of 3D modelling techniques is currently utilized in archaeological settings, little research has focused on the potential use of CRP for comparing different forensic crime scene scenarios. The application of CRP to forensic archaeological settings offers a number of contextual advantages over traditional photographic methods, including documenting the overall context of a scene that may be obscured overhead, making drones and helicopters not a viable method in these instances.

A series of three simulated forensic scenarios utilizing faux human osteological material were constructed at the Deep Foundations Geotechnical Research Site at the University of Central Florida: a simulated, partially excavated burial, a small area scatter (in wooded/scrub), and a wide area scatter (in open field and wooded/scrub). The burial scenario was exposed between 20cmbs to 25cmbs and prepared for standard field documentation. The second scenario depicted an outdoor deposit with only minimal dispersal that was constructed under a pine tree canopy with the ground surface consisting of pine needles. Photographs for the first and second scenarios were collected using both a camera hand-held and attached to a tripod. The third scenario represented a widely scattered surface deposit that extended from under the pine tree canopy out into a grassy area. Photographs for the third scenario were collected using the camera hand-held and attached to an extension pole (camera height 780cm). All scenarios were photographed with and without ground control markers and models were rendered using Agisoft® PhotoScan® Professional.

Photogrammetry results indicate that the simulated burial scenario is the most accurate scene to model, even without ground control points. This is largely due to the flat, uniform surface of the soil in contrast to the faux osteological material in a defined space. Output texture imagery is the clearest, thus providing increased visual precision compared to the other scenarios. The scenarios involving ground scatter are modeled with less accuracy due to the intrusion and complexity of the surrounding surface vegetation and pine needles that decreased the visual precision when zooming in on features. Ground control points improve accuracy results in the final models of these scenarios. Images collected utilizing the extension pole provide models with good overviews of the scene, but at a loss of the vertical accuracy of the faux osteological material. Images captured using hand-held or tripod methods are both more precise visually and accurate to the shape and size of the faux osteological material. Overall, CRP can be a useful addition to forensic archaeological scene documentation protocols. While the scene outdoor surface composition can affect the accuracy of the models created, CRP should be a recommended method for the documentation of context when recovering skeletal remains from outdoor scenes because the output capabilities will be greatly increased over traditional photography.

Reference(s):

1. Dirkmaat, Dennis C., Luis L. Cabo, Stephen D. Ousley, and Steven A. Symes. New Perspectives in Forensic Anthropology. *Yearbook of Physical Anthropology*. 51(2008):33-52.

Photogrammetry, Forensic Archaeology, Scene Documentation

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