A159 Photogrammetry Using Multiple Camera Systems of Mass Graves in a Humanitarian Context

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Learning Overview: After attending this presentation, attendees will understand the potential applications of Structure from Motion (SfM) photogrammetry in humanitarian forensic work of mass graves as an affordable and time-efficient alternative to current contextual recording methods. This presentation also provides an overview of the performance of multiple types of camera systems.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by expanding on current research of SfM photogrammetry, illustrating the potential of multiple camera systems in two types of mass graves. This research broadens the capabilities of humanitarian forensic teams by exploiting already owned or readily available camera systems and computing devices.

Two of the biggest challenges facing international humanitarian forensic efforts is the cost of keeping abreast with the latest forensic techniques and continuously expanding body of forensic knowledge. Recording the context of excavated mass graves is an essential aspect of the forensic anthropological process. The collected records can be used both in analysis and in court to provide evidence that a crime has occurred and give insight into reconstructing the crime.

Current technologies used for contextual recording and processing of mass graves, such as total station units and laser scanners, can be expensive, bulky, and time intensive. SfM photogrammetry represents an inexpensive and easy-to-use alternative for obtaining easy-to-interpret and precise 3D models of multiple types of mass graves.

For many years, SfM photogrammetry has been embraced by archaeologists as a method of preserving and recording cultural heritage at excavation sites. However, it is only in the past few years that the forensic field has seen research of SfM photogrammetry applied to mass graves. Previous research had limited image collection to one camera system while evaluating other variables.[1-3]

This research examines the abilities of multiple camera systems in image collection of two types of mass graves: a large, mechanically dug grave and a long, narrow, hand-dug trench. The images used in the study were collected from the following five camera setups: iPhone® 7 Plus still images, iPhone® 7 Plus stills taken from videos, Canon® D100 still images, Sony® a7ii stills from videos, and a simulated drone using a Canon® G9X with a tall, tilted tripod. The camera systems raged in cost and degree of automation.

The images were subsequently imported into Agisoft® Metashape® (SfM software) to create the 3D models. Multiple settings within the software were examined. Some settings were determined to be incapable of creating a viable 3D model that provides further recommendations to the field. This research also presents the current limitations of SfM photogrammetry and identifies areas needing more in-depth research and understanding for general international and *Daubert* evidentiary standards to be met. This research also highlights the necessity of properly recording and understanding the variables and settings used by SfM photogrammetry for reproducibility.

Reference(s):

1. Baier, Waltraud, and Carolyn Rando. 2016. Developing the use of Structure-from-Motion in mass grave documentation. *Forensic Science International* 261: 19-25.
2. Hardy, Shannon, and Martin Smith. *Parallel Dimensions: Exploring the potential of digital photogrammetry for the recording and presentation of mass burials*. Poster presented at: 18th Annual Conference, Association for Biological Anthropology and Osteoarchaeology, 9th-11th September 2016, University of Kent, United Kingdom.
3. Ruotsala, Anni-Helena. *Digital Clase-Range Photogrammetry—A Modern Method to Document Forensic Mass Graves.* Master's Thesis, University of Helsinki, 2016.

Structure From Motion, Forensic Anthropology, Humanitarian Forensic Science

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