Science, Technology, & Archaeology

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• Assistant Professor of Classical Archaeology and Digital Humanities, Department of Classical Studies, Brandeis University

• PhD, Boston University (Classical and Near Eastern Archaeology)
  • Postdocs: Fulbright, University of Haifa Presidential Postdoc, National Endowment for the Humanities

• Interests: Archaeology of the Eastern Roman provinces, Ceramics, Bronze Age Archaeology, Digital Humanities and New Technologies, Maritime Archaeology Ancient Economies, Imperialism, Roman Army, Mystery Cults.

• Excavations & Projects: Tel Kabri, Roman Fort at Yotvata, Tel Dor, Survey of the Roman and Byzantine Army in the Negev, Tel Achziv, Caesarea, Birsama (Be’er Shema, Late Roman Fort)

• Teaching: Boston University, University of Haifa, Brandeis University

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Tel Kabri – MBI Tomb (3D modeling)

Tomb filled with 42 complete vessels, metal objects, portions of 5 adults and 3 children.
Landscape Photogrammetry at Tel Kabri
(MBI Tomb Modeling ~ Erin Brantmayer, Brandies MA’18)
LIDAR @Tel Kabri Wine Cellar
DNA extraction for genetic testing
DNA extraction from “clean” (undisturbed) surfaces and from the inner ear allows scientists to reconstruct the genetic fingerprint of ancient people.
- This helps us understand where people moved to and settled, and which groups came from different places.
- We use this information and compare it to the artifacts they left behind.
Birsama (Horbat Be’er Shema)

- Birsama is situated in the northwest quadrant of the northern Negev, approximately 21 km southeast of Gaza and 25 km northwest of Beersheba.
- It lies along the desert fringe to the south and arable land to the north.
Project Aims

• Investigate the late Roman fort (quadriburgium) and its environs (- i.e. vicus, road, industrial complexes, bath houses, churches, etc.)

• Explore the development of the Roman army and regional administration’s connection to the broader network across the Negev during the Late Roman – Byzantine periods.

• Clarify how the Roman army used the site as a strategic economic and administrative base close to the port at Gaza.

• In addition to elements of the built environment, research also focuses on the material culture as it is related to the trade routes extending across the Negev and access to the broader Mediterranean through Gaza.

Birsama depicted in the Notitia Dignitatum (c. 390 CE for Eastern Empire) - Illuminated by Peronet Lamy in 1436
SPOT the Robot Dog [Boston Dynamics]

Late Roman Fort at Birsama (Israel) – Summer 2023
From Excavation to Innovation

The Problem: Need for better/varied options in digital imaging

Process: Autodesk & the Techne Group

Solution: SCAPP
Design and construction of the SCAPP at the Autodesk Boston Technology Center.

[sciencethepast.com]
New Developments in Digital Imaging for Archaeology

Brandeis Techno Group at Autodesk

THE PROCESS

Design and fabrication of an automated goniometry system to move a dual-camera system in a 4-axis circuit around an object in order to take 30-180 photos at 64-bit processed in photogrammetry software. The output generated through these programs provides a scale and color accurate 3D model, best for challenging objects with high specificity.

- The SCAPP was specifically designed to be user-friendly. By normalizing the photogrammetry pattern, we get a clean data set that is required for post-processing and can be rendered in any Photogrammetry software with good results.
- The final photogrammetry was constructed in such a way to the parameters of camera angles and the brightness of the general terms in the system. The green laser was to have a minimum viable prototype to die in optimized photogrammetry acquisition patterns.
- In the second measurement of the SCAPP prototype frame was cut from a 0.020-inch material. A robotic arm was constructed to control a camera from an industry standard 3D printer controller. "Rapid Scan" - the materials were chosen for accessibility and availability cost.

- The SCAPP operated essentially as if it were a 3D printer. It used a printer control board, but moves and actuated a 3DLS or printer.
- SCAPP can deliver function as a non-intrusive circular tripod in which data acquisition can be done manually while maintaining the internal design and position of the camera.
- SCAPP can scan delicate, fragile, and fragile objects with a weight of 10-50 pounds, and to do so automatically (taking advantage of custom and setup and breakdown rapidly).

FIELDWORK

- Designed as a portable imaging tool, SCAPP testing has included laboratory settings such as those at Brandeis, the classroom, and an environmental workshop. Initial SCAPP test testing was carried out in the summer of 2018 at the Kuli Kuli (located by Alexandra Ratzlaff and Erin Brantmayer of the Techno Group, where it was confirmed on the field by the outdoor team, and the field is located by the outdoor test.
- After the success of the test, the group is continuing to improve and refine the engineering and design of the SCAPP through collection and data collection primarily on artifacts from the Brandeis CLRC (Digital Artifact Research Collect.)

RESULTS

- Successfully in the fabrication of the SCAPP as a portable piece of archaeological equipment visible in the field and laboratory settings.
- Needs areas where objects are too small or too delicate for SCAPP can provide a better data acquisition than comparable methodologies including traditional handheld photogrammetry and, in some instances, reflectance light 3D scanning with a whole field.
- SCAPP was able to provide consistent images that when processed produced results exceeding expectations.

SIGNIFICANCE TO THE FIELD

- The SCAPP offers a gap between traditional handheld photogrammetry and 3D, and the limits of Structured Light or Laser Scanners to each with specialized objects.
- The SCAPP user was developed specifically to use in places where specialized equipment is not available. Many times these objects are damaged during excavation, are not visible to other types of 3D scanners.
- Project represents a successful partnership between an academic institution, Brandeis University, and a technology, industry leader with the corporation Autodesk.
- Scientific, army, and military scanners can be a challenge for Structured Light and Laser-based 3D Scanners. Photogrammetry is a popular alternative, but requires the operator to make strategic decisions.

Facts about SCAPP:
- SCAPP is 3D imaging from the field and laboratory settings.
- Processing a SCAPP image dataset in Reality Capture.
- 30% more than the field without using the SCAPP.

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*Brandeis University, **University of Texas at Austin, *Oxford University
@home Summer 2020 Experimental Set-Ups
Techne Group "@ home / together"

Build your own Monument Challenge
“Pizza-Giza”
AIA Build Your Own Monument Challenge

IAD Build Your Own Monument Challenge 2020

Giza Entry 34734
Submitted by Alexandra in behalf of the "Brambles Norton Digital Humanities Group "Kurds"
This model is inspired by the "Pizza-Giza" monument in Egypt. The monument is a virtual recreation of the original "Pizza-Giza" monument, incorporating elements of ancient Egyptian architecture and culture.

Washington, WA, United States
Category: Adults
Classical Artifact Research Collection (CLARC)
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- Collection houses approx. 800 artifacts, predominantly from the Levant (modern day Israel), predominantly ranging in date from the Bronze Age (c. 2000 BCE) through the Medieval Period, with a variety of North American artifacts as well.

CLARC webpage (linked from the Department of Classical Studies):
[https://www.brandeis.edu/classics/clarc/index.html]
CLARC Aims:

- Artifact Analysis
- Preservation and Conservation
- Curation and Presentation
• Using the SCAPP (Single Camera Automated Protogrammetry Platform) to create a 3D models of this CLARC Hellenistic Moldmade Bowl (1st/2nd c. BCE) and then printing a miniature version of the bowl.
Modeling ancient ceramics for analysis
Palestinian Bag Jar (LRA5)
Palestinian Bag Jar (LRA5)
CLARC & TECHNE

3D modeling and printing

Roman glass vase modeled from photogrammetry and 3D prints of Roman lamps both from the CLARC collection.
Student Project: Scanning Assyrian reliefs and creating 3D prints on the Autodesk BigRep printer (this print took 8 days!)
CLARC & Techne

FARO laser scanning arm loan from Autodesk
CLARC & Techne

FARO laser scanning arm loan from Autodesk
Real World → to Virtual Reality
Intern Jalon Kimes, VR specialist & co-designer of VR CLARC (with Hazal Uzunkaya).
CLARC & TECHNE “Virtual CLARC Museum”
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How we think about Technology and Archaeology…