tDAR (the Digital Archaeological Record) and 3D and Sensory Data

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School of Human Evolution and Social Change
Arizona State University

Presentation at Community Standards for 3D Data Preservation Conference
Washington University, St. Louis, 5 – 7 February 2018
Data in archaeology, from mid-1970s…:

- Planning efforts consider the effects of public undertakings on archaeological resources.
- Cultural Resource Management (CRM) gets underway. Big increase in number of studies.
- An abundance of archaeological information is produced. Computers become important tools.
- Millions of archaeological investigations worldwide, academic and public archaeology: collections research, overviews, surveys, & excavations.
New Challenge: Managing Data and Information

Grey Lit

Data on paper
The Bad News

An underutilized “gold mine” of data and information has accumulated.

• Without data curation, we risk losing the investment of funding and human energy in archaeological information.
• Limited means to find & access info.
• Danger of losing information because it is forgotten.
SOURCES:
Jeffery Altschul (2017) - Data and information from Journal of Arizona Archaeology.
Departmental Consulting Archeologist Reports on the Federal Archeology Program (2009) and (2010)

Table 1. Summary Data from the Federal Archaeology Program (1985-2012)

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Field Studies</th>
<th>Annual Acres Surveyed</th>
<th>Annual Sites Recorded</th>
<th>Data Recovery (Projects)</th>
<th>Data Recovery (Sites)</th>
<th>Cumulative Field Studies</th>
<th>Cumulative Acres Surveyed</th>
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Standard Deviation: 20,640
Average: 30,403
Total: 851,271

Compound Annual Growth Rate: 15.37%, 12.85%, 13.16%
Dealing with Data – A Widespread Challenge

2011 survey by *Science* Editors and special section “Dealing with Data”

“Even within a single institution there are no standards for storing data, so each lab, or often each fellow, uses ad hoc approaches.”

Where do you archive most of the data generated in your lab or for your research?
To Ignore Digital Curation is to Risk Losing Important Data

- files that won’t open
- software that cannot “read” old files
Data are not accessible for those who need access
- Archaeological projects typically do not move digital data into repositories where they are accessible
- Few institutions provide digital curation (which ensures access and preservation)
- Paper files are not easily accessible or shared
- Media on which data reside are treated as artifacts

Data are fragile and are not preserved automatically
- Media degrade
- Software become obsolete
- Information about the data (metadata) are lost

Digital curation requires special knowledge, skills, and procedures not often available in physical repositories
“Managing digital data isn’t a job that can be left to chance…managing data is a full-time responsibility, and one that is so complex that it can’t be done effectively in an *ad hoc* manner.”
The Center for Digital Antiquity (Digital Antiquity)
- An academic center at ASU with an independent multi-institutional and local broad-based Board of Directors
- Executive Director and small full-time staff

tDAR – the Digital Archaeological Record
- Digital Repository - Data and Software

History
- NSF – Human Social Dynamics, Archaeology, & CISE
- Planning began in 1999; initial funding 2004
- Since 2010 tDAR has been a public digital repository

Current and Long Term Business Model
- Substantial revenue from digital curation fees and services (no access free for using information in tDAR)
- Diverse clients: DoD, USAF, CoE, BLM, BRec, NABO, USCBS, individual researchers, more
- ASU Libraries safety net
<table>
<thead>
<tr>
<th></th>
<th>Documents</th>
<th>Datasets</th>
<th>Images</th>
<th>Geospatial</th>
<th>Sensory &amp; Scan Data</th>
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<tr>
<td><strong>Physical Data</strong></td>
<td>Paper notes, documents, correspondance, reports, books, and other textual information</td>
<td>Photo logs, artifact catalogs, faunal analysis, grosso modo, sampling results</td>
<td>Photos, drawings, artifacts, samples, etc.</td>
<td>Maps</td>
<td>Physical models and reconstructions, landscape</td>
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<td><strong>Digital Formats</strong></td>
<td>PDF, Word Documents, Rich Text, and Plain Text files</td>
<td>XLS, CSV, TAB, .MDB, and other databases</td>
<td>TIFF, JPG, PNG, GIF, and other image formats</td>
<td>Shapefiles, KML, GeoJPG, GeoTIFF, Personal Geodatabases</td>
<td>3D scans of artifacts or sites, LIDAR, and GPR</td>
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Bar chart showing the count of different types of data:
- Images: 10859
- Ontologies: 56
- 3D & Sensory Data: 158
- Projects: 862
- Datasets: 1072
- Coding Sheets: 958
- GIS: 84
- Documents: 363358
tDAR Worldwide Content

Covering the World of Archaeology. Preserving Your Data.

Find useful information.
Upload your own materials as affordable as $5/file.
tDAR – US Content

Thousands of reports covering the entire United States

Major archaeological reports from all 50 states. Covering a wide range of time periods from Paleo-Indian to present. Search by site name, location, culture, date, or material type. Reports from CRM firms, Federal, State, and local government, and academic archaeology all in one place.

tDAR Highlights the Work of CRM Archaeology Across the United States

The Digital Archaeological Record (tDAR) is an international digital repository with information about archaeological investigations, research, and resources. tDAR provides tools to discover, access, and integrate relevant archaeological information. Users can search tDAR for digital documents, data sets, images, and other information from archaeological projects and topics spanning the globe.

Learn more at http://www.tdar.org/acra
tDAR contains 158 3D sensory datasets. Most (n=138) are scans of ceramic pottery from the Virtual Hampson Museum (http://hampson.cast.uark.edu/).

These artifacts are in the collections at the Hampson Archeological Museum State Park in Wilson, Arkansas.

All artifacts were scanned in full color with the Konica Minolta VIVID 9i laser scanner.

The ADS and Center for Digital Antiquity Guide to Good Practice for Laser Scanning guideline was used for this project (http://guides.archaeologydataservice.ac.uk/g2gp/LaserScan_Toc)

Each of the tDAR scan records includes raw scan files, a registered dataset, a premesh dataset, a mesh dataset, a decimated mesh dataset, images, and appropriate metadata for each artifact.
tDAR guidance and documentation:

- [https://tdar-arch.atlassian.net/wiki/spaces/TDAR/pages/557074/Working+With+3D+Sensory+Data+Objects](https://tdar-arch.atlassian.net/wiki/spaces/TDAR/pages/557074/Working+With+3D+Sensory+Data+Objects)
  - Describes 3D Sensory Dataset
  - Downloading guidance
  - Free downloadable software for point clouds
  - Opening and using the dataset
Virtual Hampson Museum Project

Summary

The Virtual Hampson Museum located at http://hampson.cast.uark.edu/ showcases a series of 3D digital artifacts from the collections at the Hampson Archeological Museum State Park. All artifacts were scanned in full color with the Konica Minolta VIVID 9i laser scanner. One hundred forty of these artifacts are archived with tDAR. In compliance with the ADS Guide to Good Practice for Laser Scanning document, the archive includes raw scan files, a registered dataset, a premesh dataset, a mesh dataset, a decimated mesh dataset, images, and appropriate metadata for each artifact.

This Resource is Part of the Following Collections

Center for Advanced Spatial Technologies (CAST) Virtual Hampson Museum

Cite this Record

Virtual Hampson Museum Project. (tDAR id: 6317); doi:10.6067/XCV8oG3MM0

Keywords

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https://core.tdar.org/project/6317/virtual-hampson-museum-project
Virtual Hampson Museum Project

Local Coverage

Individual & Institutional Roles
Contributor(s): Katie Simon
Principal Investigator(s): Fredrick Limp
Project Director(s): Angie Payne

Administrative Information
Total # of Resources  Total # of Files  Total Space (Uploaded Only)
159 801 15,844.96mb

Created by  system user on Jun 7, 2011 1:42:00 PM
Last Updated by  Francis McManamon on Jul 6, 2012
Viewed  4,818 time(s)

Access Permissions

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Resources Inside this Project (Viewing 1-100 of 159)

Document (1)  3D & Sensory Data (136)

Documents
1. Developing a 3D digital heritage ecosystem: from object to representation and the role of a virtual museum in the 21st century (2011)
3D & Sensory Data

https://core.tdar.org/project/6317/virtual-hampson-museum-project
Ark_HM_0173: An owl effigy bowl

Part of the Virtual Hampson Museum project

Year: 2008

Summary

An owl effigy bowl

This Resource is Part of the Following Collections

Center for Advanced Spatial Technologies (CAST) Virtual Hampson Museum

Cite this Record

Ark_HM_0173: An owl effigy bowl. 2008 (TDAR id: 6524); doi:10.6087/XCV82Fa4tw

Object #: NA

Conditions: Indoors

Scanner Details: Konica Minolta VIVID 91; mm Serial No. 1001498

Company Name: Center for Advanced Spatial Technologies, Christopher Goodmaster

Turntable Used: Yes

The VIVID 91 uses internal RGB capture. A three point lighting system was used to illuminate the object from the top and from both sides; this minimized shadows on the object. Each light in the system had 1-2 white light (3000K) flacker free fluorescent bulbs. The number of bulbs that were used to illuminate each artifact varied depending on ambient light conditions and object color.

Data Resolution: 0.293

Number of Scans: 10

Description of Final Data sets for Archive: Original scan, registered dataset, promesh dataset, mesh dataset, decimated mesh dataset, images

Sensory Data Image Information

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Registration Information

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Registration Error: 0.000

# Points in File: 5,117,187

Mesh Information

Pre-mesh

Dataset Name: Ark_HM_0173.owl.txt

# Points in File: 5,117,187

Point Editing Summary: Multiple data points were also deleted. Data remnants from overlap reduction were also deleted.

Overlap Reduction: Yes

Smoothing: No

Subsampling: No

Color Edges: No

Polygonal Mesh Metadata

Dataset Name: Ark_HM_0173.owl.txt

Number Triangles: 602,928

Additional Processing Notes: NA

Holes Filled: Yes

Smoothing: Yes

Color Edges: No

Heading/Despiking: Yes

RGB Color Included: Yes

https://core.tdar.org/sensory-data/6524/ark_hm_0173-an-owl-effigy-bowl
# Hampson Museum – Owl Effigy Bowl

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![Owl Effigy Bowl](ark_hm_0173_02.jpg)

## Keywords

**Culture (from project)**
Mississippian • Yorktown phase

**Material (from project)**
Ceramic • Chipped Stone • Ground Stone • Shell

**Site Name (from project)**
Hampson Archeological Museum State Park; Wilson, AR

**Site Type (from project)**
Funerary and Burial Structures or Features • Settlements

**Investigation Types (from project)**
Collections Research

**General (from project)**
3D artifact scan • 3D model • 3D pottery • 3D scanning • Hampson Museum

**Geographic Keywords (from project)**
Northeast Arkansas

System Managed Geographic Keywords (11) show

[https://core.tdar.org/sensory-data/6524/ark_hm_0173-an-owl-effigy-bowl](https://core.tdar.org/sensory-data/6524/ark_hm_0173-an-owl-effigy-bowl)
## Center for Advanced Spatial Technologies (CAST) Virtual Hampson Museum

### Usage Stats

**2017 Stats:**
- 8,882 pageviews
- 31 downloads

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**Results: Year**

| Id   | Title                                                                 | Resource Type     | Status       | 2010 Views (Bot) | 2010 Views (Total) | 2011 Views (Bot) | 2011 Views (Total) | 2012 Views (Bot) | 2012 Views (Total) | 2013 Views (Bot) | 2013 Views (Total) | 2014 Views (Bot) | 2014 Views (Total) | 2015 Views (Bot) | 2015 Views (Total) | 2016 Views (Bot) | 2016 Views (Total) | 2017 Views (Bot) | 2017 Views (Total) | 2018 Views (Bot) | 2018 Views (Total) | 2019 Downloads |
|------|-----------------------------------------------------------------------|-------------------|--------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|
| 6559 | Ark_HM_0730: A 7-inch tall bottle with a flared neck and red stylized stripes representing four bands and fingers   | SENSORY_DATA      | ACTIVE       | 0                | 0                 | 24               | 0                 | 58               | 0                 | 34               | 0                 | 28               | 0                 | 83               | 0                 | 116              | 80               | 219              | 3                 | 12               | 0                 |
| 5552 | Ark_HM_0456: A bottle with cross-hatching designs separated by a series of three parallel diagonal lines              | SENSORY_DATA      | ACTIVE       | 0                | 0                 | 20               | 0                 | 62               | 0                 | 35               | 0                 | 28               | 0                 | 105              | 0                 | 127              | 58               | 190              | 2                 | 10               | 0                 |
| 5446 | Ark_HM_0423: A bottle                                                                                                   | SENSORY_DATA      | ACTIVE       | 0                | 0                 | 25               | 0                 | 56               | 0                 | 40               | 0                 | 46               | 0                 | 102              | 0                 | 116              | 86               | 240              | 6                 | 17               | 0                 |
| 5624 | Ark_HM_0474: A bottle                                                                                                   | SENSORY_DATA      | ACTIVE       | 0                | 0                 | 21               | 0                 | 60               | 0                 | 24               | 0                 | 18               | 0                 | 81               | 0                 | 104              | 87               | 240              | 1                 | 8                | 0                 |
| 5526 | Ark_HM_0289: A bottle with four painted spiral designs                                                                    | SENSORY_DATA      | ACTIVE       | 0                | 0                 | 22               | 0                 | 55               | 0                 | 59               | 0                 | 49               | 0                 | 97               | 0                 | 103              | 95               | 253              | 5                 | 15               | 0                 |
What Price is Right?

• Now in tDAR, 158 3D Sensory Datasets (objects or terrestrial).
  39 GB (~39,000 MB) total, compressed as Zip files; average size each dataset: ~ 250 MB

• Estimated uncompressed file size 2-3 times compressed.

• Estimated actual file sizes: 500 – 750 MB.
What Price is Right?

- Current Center for Digital Antiquity pricing is $5/file (each file allotted 10 MB).
- Estimated price for long-term digital curation (to ensure discoverability, accessibility, and usability):
  - 500 MB = 50 * $5 = $250
  - 750 MB = 75 * $5 = $375
Challenges of Archiving 3D Files

• Maintaining expertise in fast-moving technology
• What administrative, disciplinary, and technical metadata should be recorded?
• What file formats will be most durable and useful long-term
• What costs (staffing and data storage) need to be met for long-term preservation?
Digital Antiquity and tDAR: Q & A

For more details:

www.tdar.org
www.digitalantiquity.org

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End of 5 February presentation slides.