

SunoikisisDC Digital Approaches to Cultural Heritage
2022 session 3

3D Imaging & Museum Research

Gabriel Bodard (University of London)
Daniel O'Flynn (British Museum)
Daniel Pett (Fitzwilliam Museum)

3D methods

3D methods

1. 3D imaging (scanning)
2. 3D modelling (visualisation)
3. Virtual Reality
4. Augmented Reality
5. 3D printing

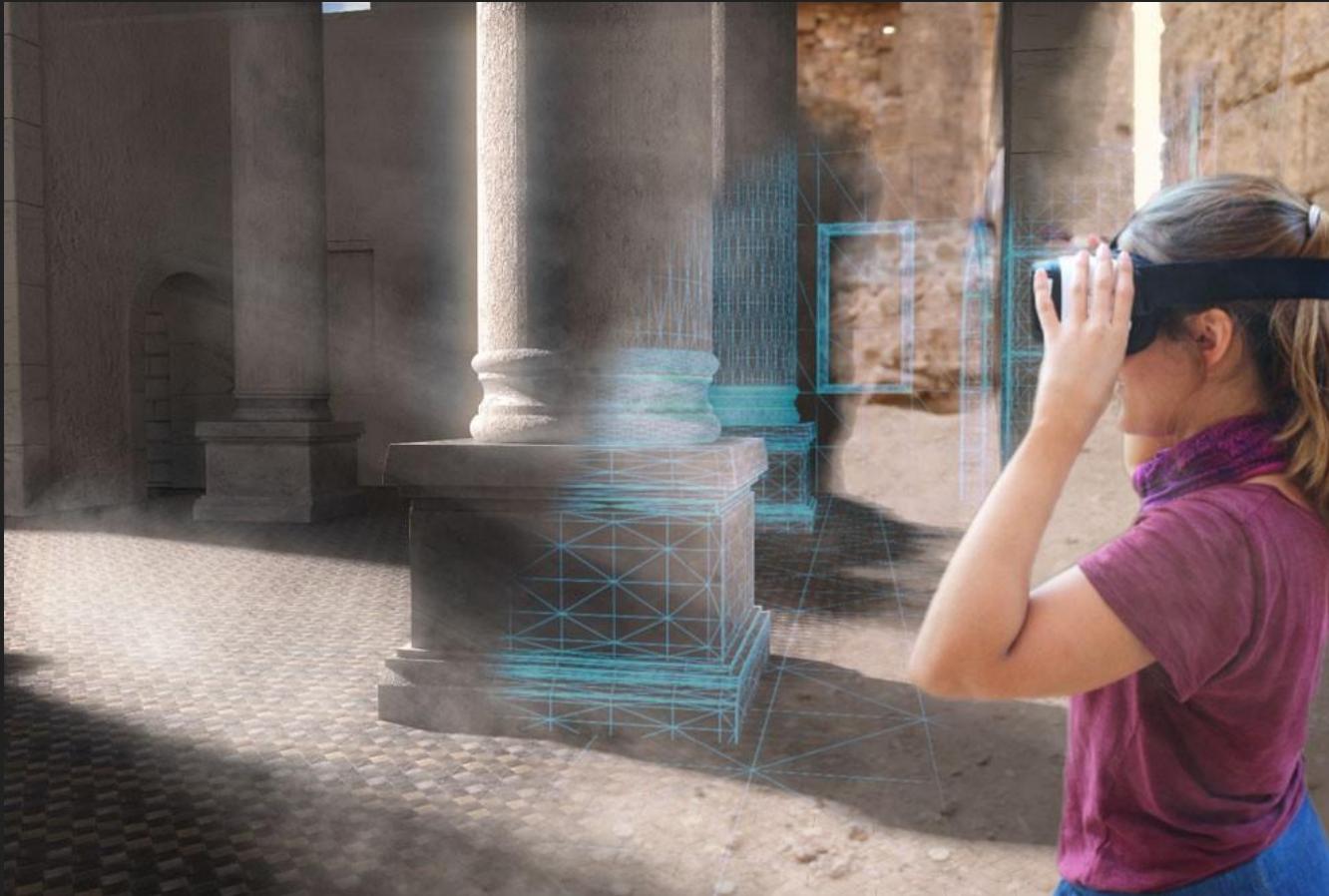
1. 3D imaging or scanning



2. 3D modelling or visualization



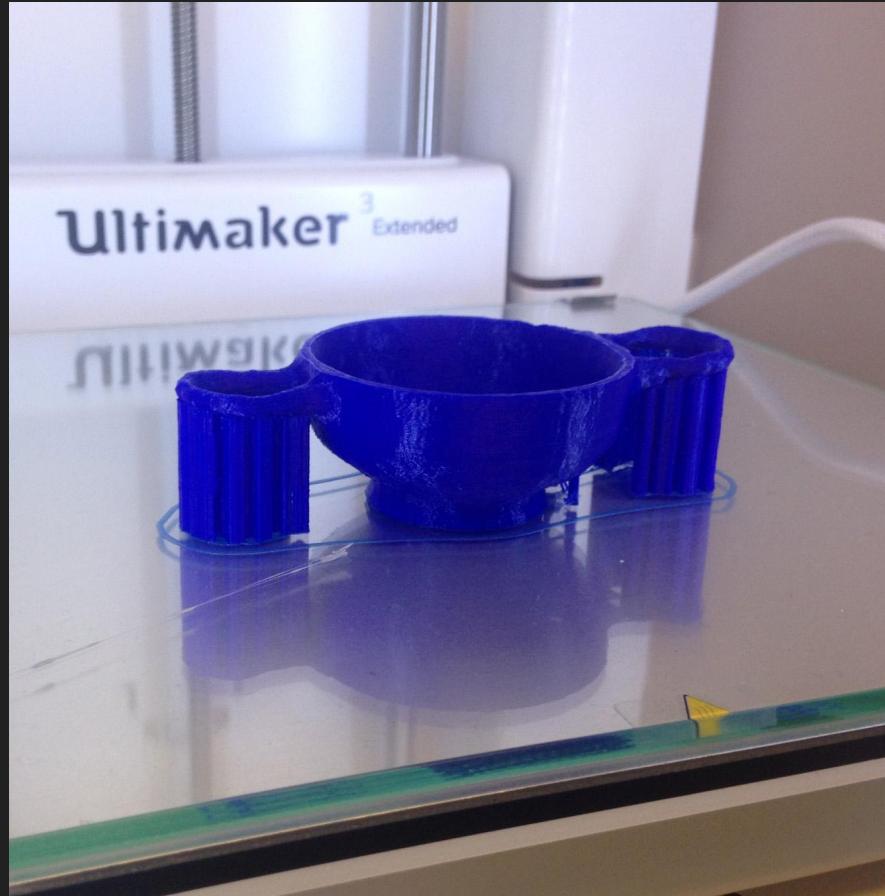
3. Virtual Reality (VR)



4. Augmented Reality (AR)



5. 3D printing

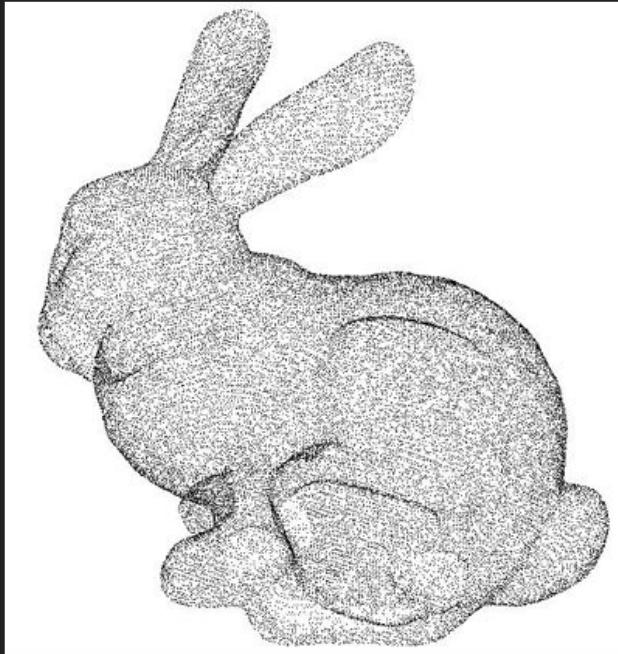


3D imaging

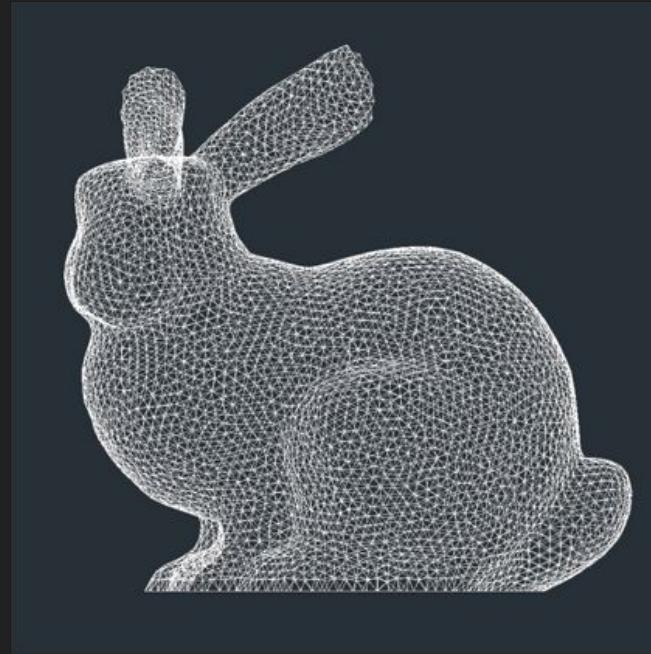
3D technologies and formats

1. Point cloud vs mesh
2. Laser scanning:
 - a. time of flight / triangulation / structured light
3. Computer Tomography / XRay
4. Photogrammetry / Structure from Motion
5. Reflective Transformation Imaging

3D Imaging outputs



Point Cloud



3D Mesh

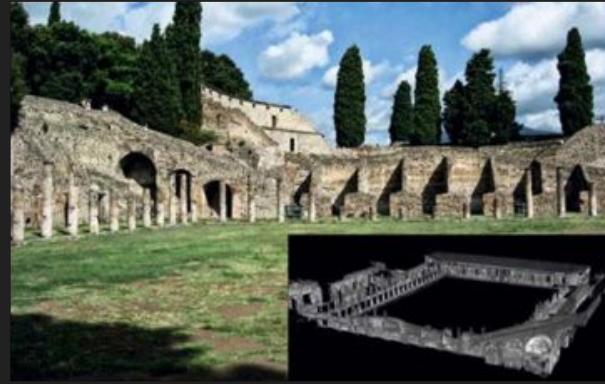
Laser Scanning Time of Flight

PROS

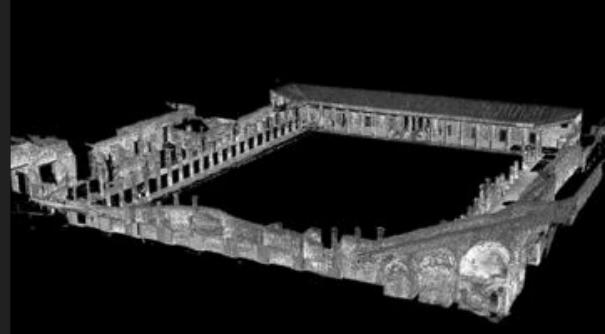
- * Good geometric fidelity
- * Suitable for large areas

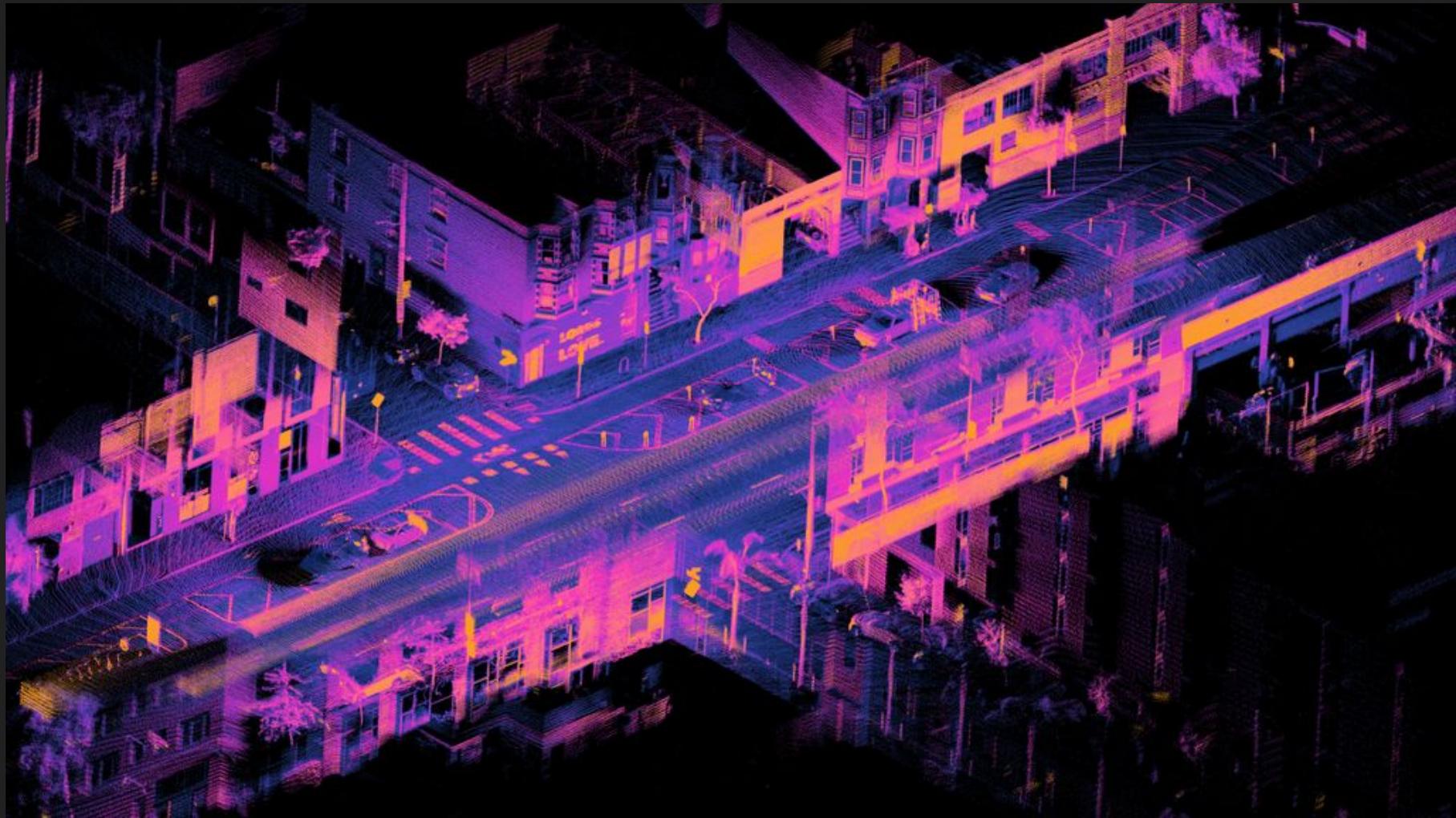
CONS

- * Cost
- * Massive data set
- * Slow process
- * Not accurate on smaller artefacts



The Pompeii Quadriporticus Project





Laser Scanning Triangulation

- * Cheaper
- * Better on smaller surfaces (not adequate for larger ones)
- * Portable
- * Ready to use

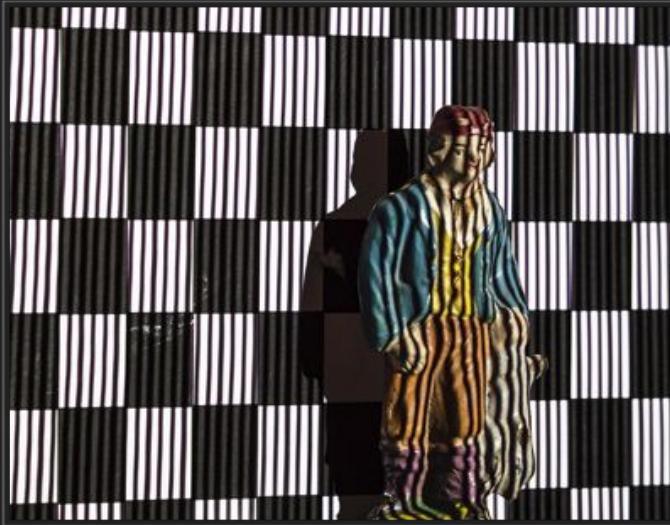


<http://surveyequipment.com/faro-scanner-freestyle-3d/>



<http://www.nextengine.com/>

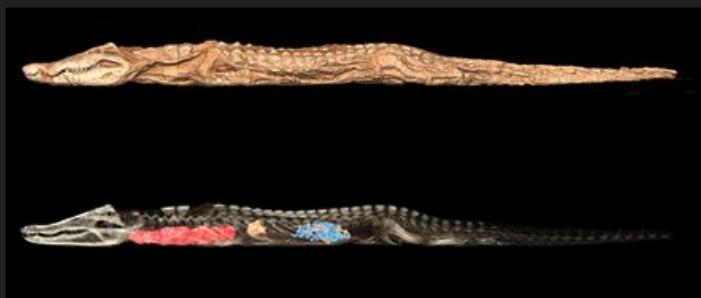
Structured Light



3D scanning by Structured Light using a mini (pico) projector coupled with the “3D scanning software” developed by D. Moreno and G.Taubin at Brown University School of Engineering.

- * Fast
- * Accurate
- * Has to be performed in a studio
- * Requires calibration
- * Is slightly out of date, but still used and researched

CT Scan (Computed Tomography)



- * Expensive
- * Non portable
- * Requires training
- * Non invasive
- * Virtual autopsy

Images of CT scans used by the British Museum for the exhibitions
“Ancient Lives, New Discoveries” and “Scanning Sobekh”.

Photogrammetry

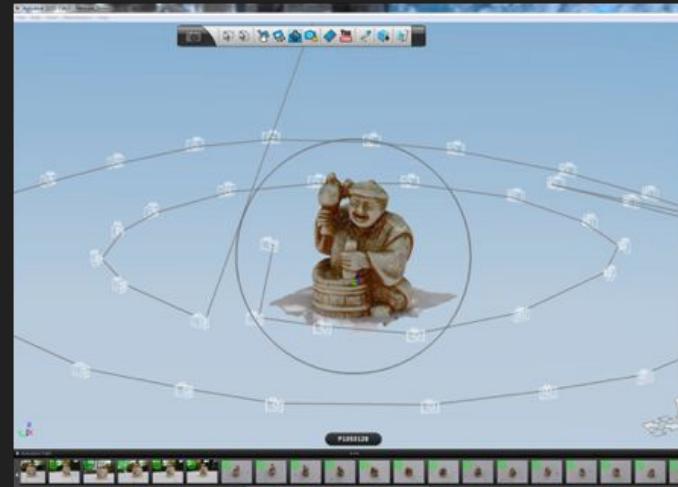
- * Based on triangulation
- * Cheap
- * Easy to learn
- * Portable equipment
- * 3D mesh as an output

Agisoft Photoscan

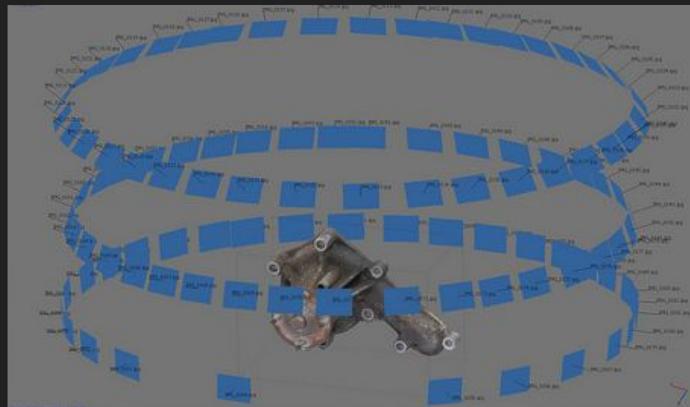
<http://www.agisoft.com/>

3DF Zephyr

<https://www.3dflow.net/3df-zephyr-free/>



Capture with 123D catch <http://www.tcpproject.net>



Capture with Photoscan <https://www.flickr.com/photos/erik-nl/sets/72157628813159493/>

Structure from Motion

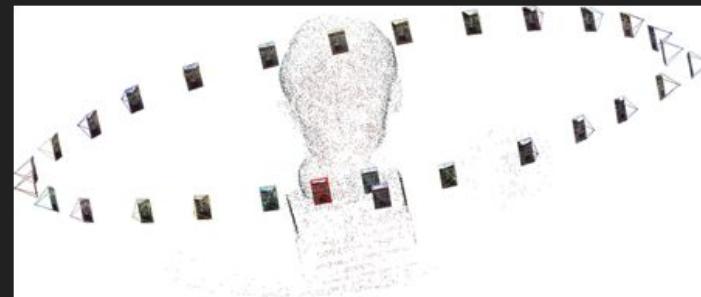
* Similar to Photogrammetry

Visual SfM

* Cheap

<http://ccwu.me/vsfm/>

* Relatively simple to use (but requires more IT skills)



* Accurate colour information



* Long processing time

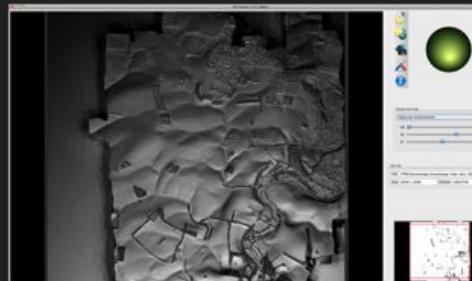
* Output in point cloud

Reflectance Transformation Imaging (RTI)

- * Virtual relighting
- * Cheap (when not performed with the dome)
- * Free software
- * Can only be seen (easily) in the viewer



www.topoi.org



<http://www.wessexsearch.co.uk>

The British
Museum



X-ray CT Imaging in Museum Research

Dan O'Flynn

Department of Scientific Research
The British Museum



@danoflynn

X-ray imaging in the Museum

How was it made?

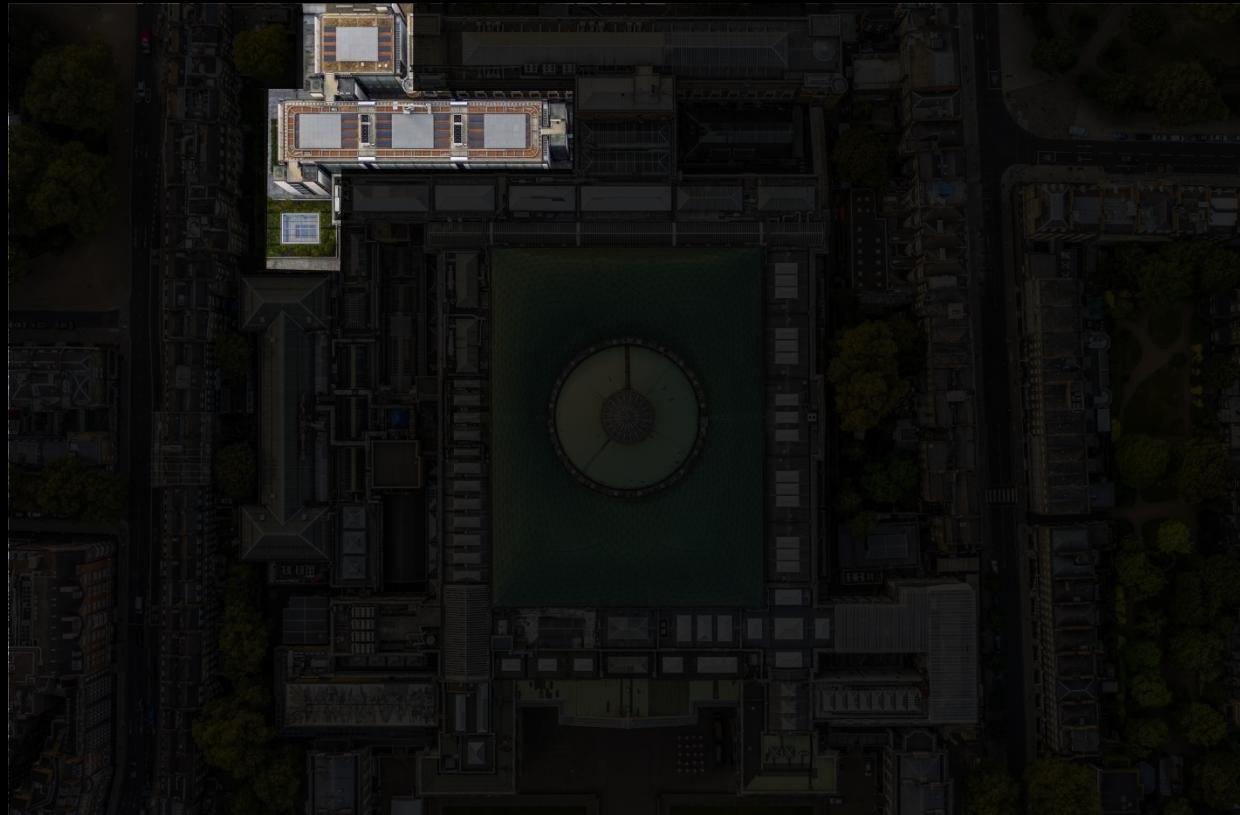
- Materials, techniques

What condition is it in?

- Damage, repairs

Is there anything hidden inside?

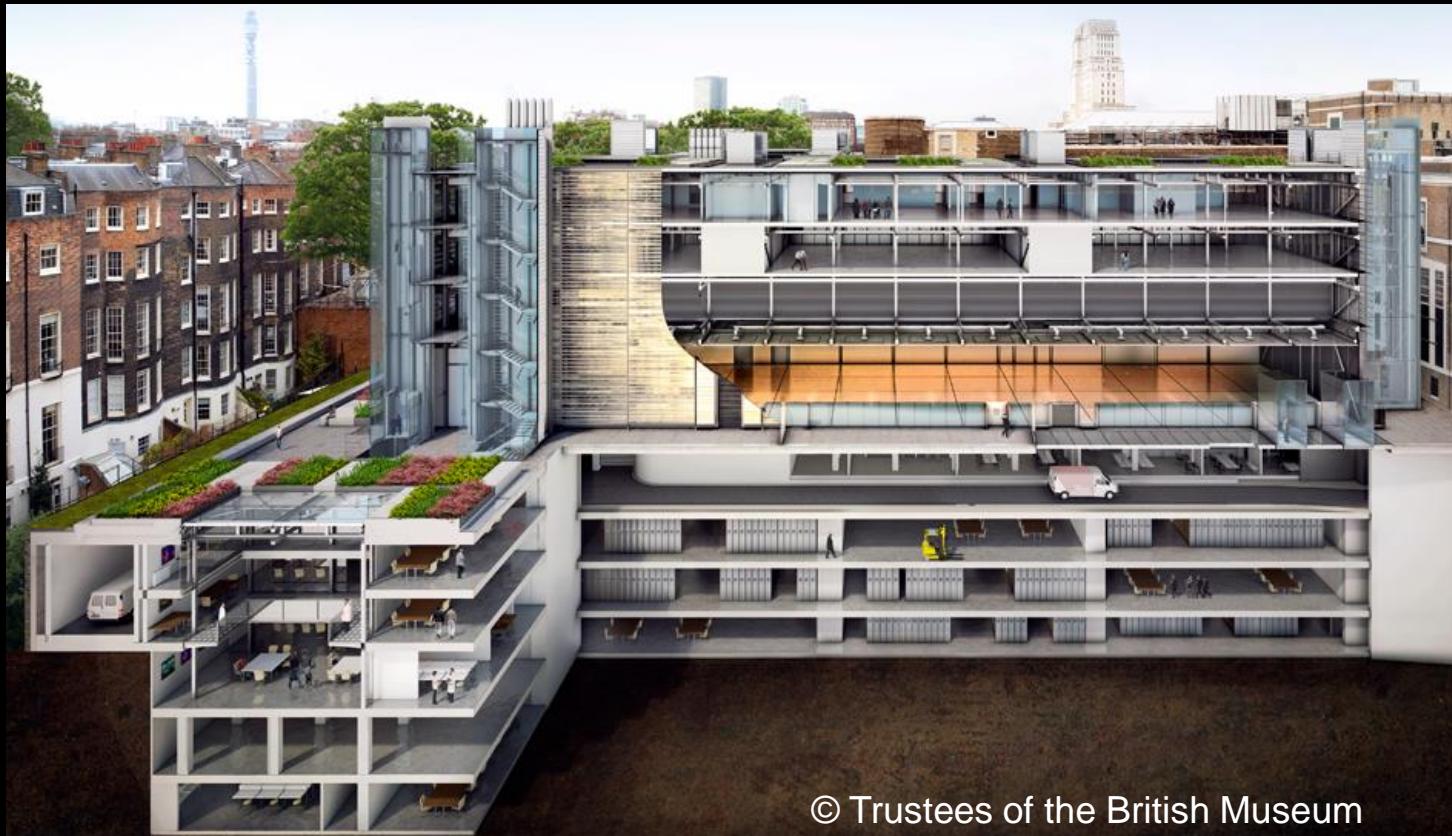
The British Museum



Credit: Jeffrey Milstein/Rex/Shutterstock

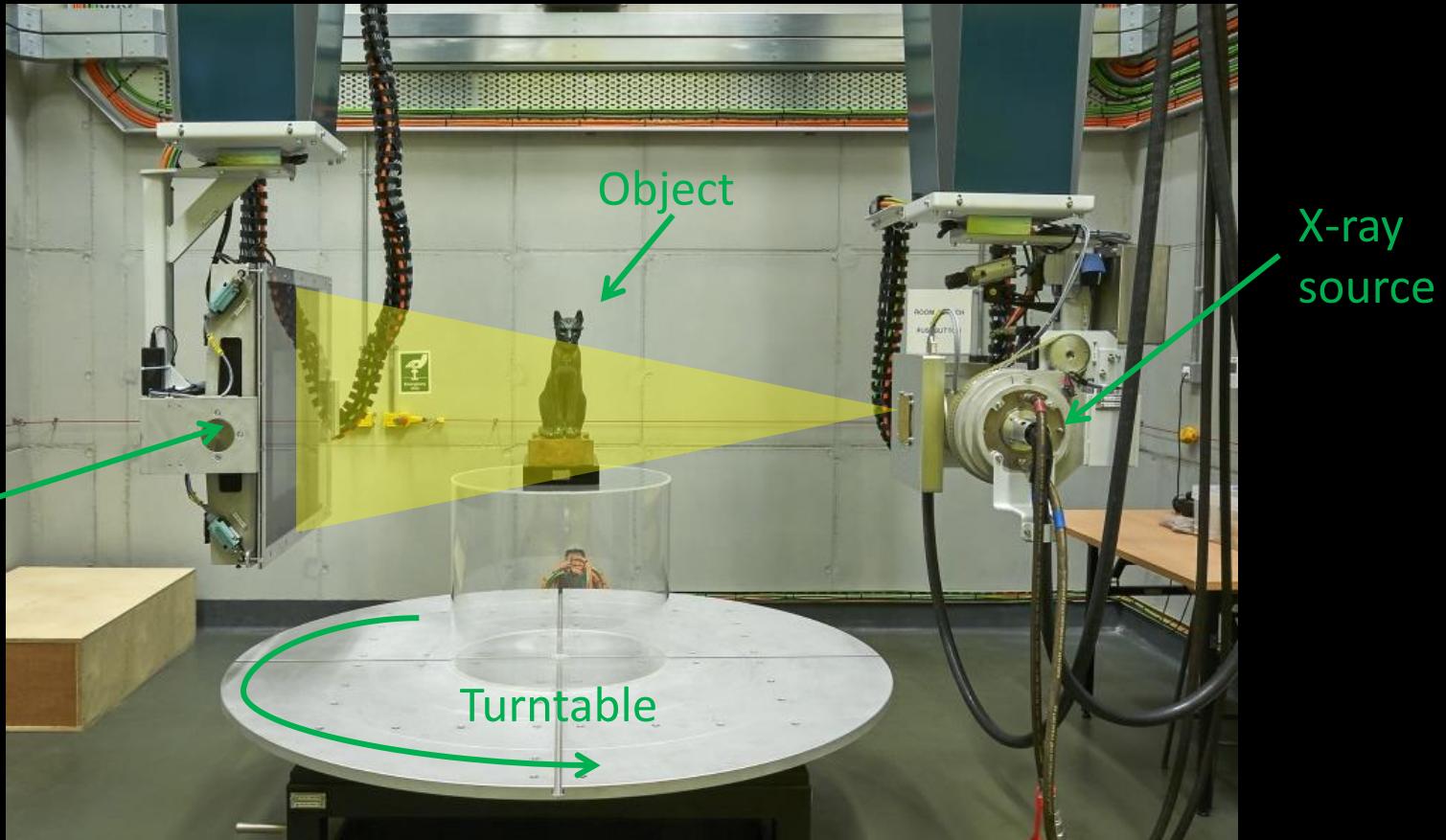
The British
Museum

World Conservation and Exhibitions Centre



© Trustees of the British Museum

X-ray Imaging Lab

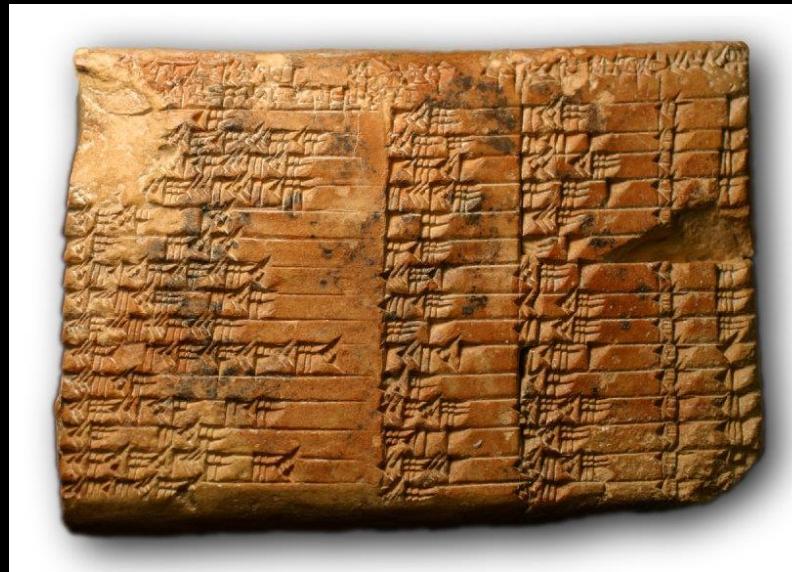


The British
Museum

Cuneiform tablets



UPM CBS 6043
© Penn Museum



Plimpton 322
© Christine Proust and Columbia University

Cuneiform Tablet

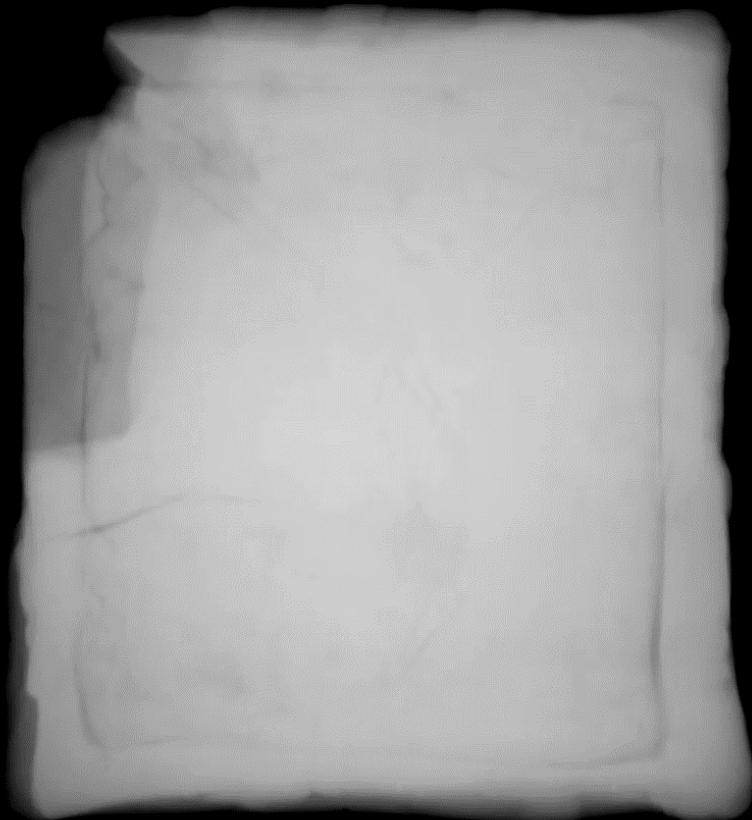
Girsu, present-day Iraq
3rd Millennium BC

1896,0612.112 (ME15892)

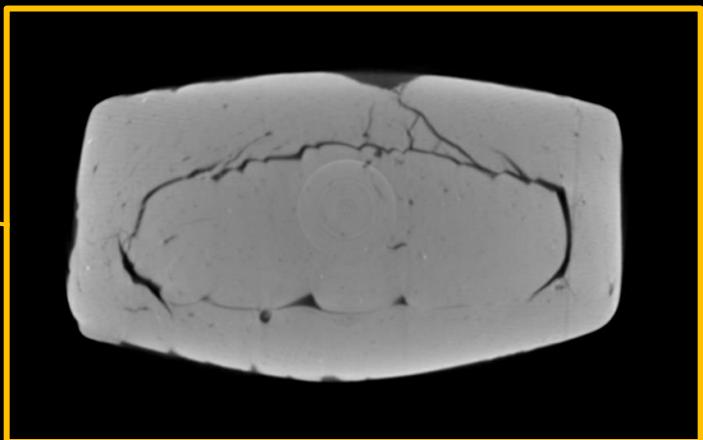
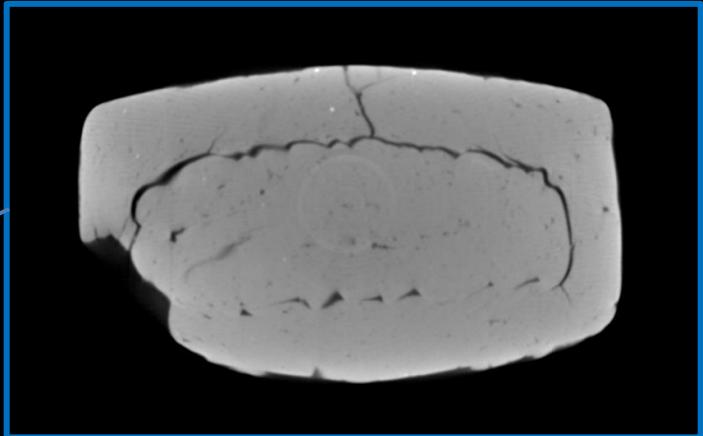


← 4.5 cm →

Radiographs - “Projections”



X-ray CT slices



X-ray CT volume render



The British Museum

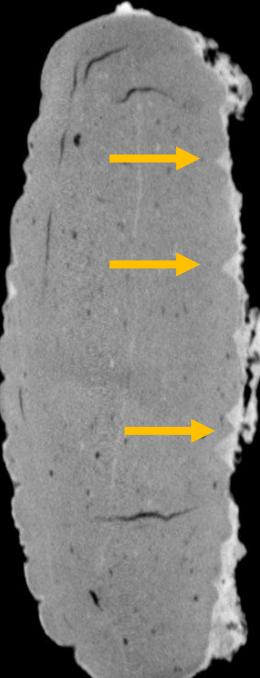
Translated by Jonathan Taylor
(Curator, BM Middle East Department):

*2427kg wool, as rations for the men of
(the village) Gaka, under the
supervision of the chief minister, via
(Mr) Shesh-Utumu, from (Mr) Aradmu,
governor of (the city) Girsu, have been
withdrawn.*

(Sealed with) the seal of (Mr) Babati.

Year Shu-Sin became king





“.....the Cuneiform tablets are heavily encrusted with finely crystallized selenite which covers and completely blocks up the inscriptions.....”
Alexander Scott, October 1919

The British
Museum

Mummy Mask

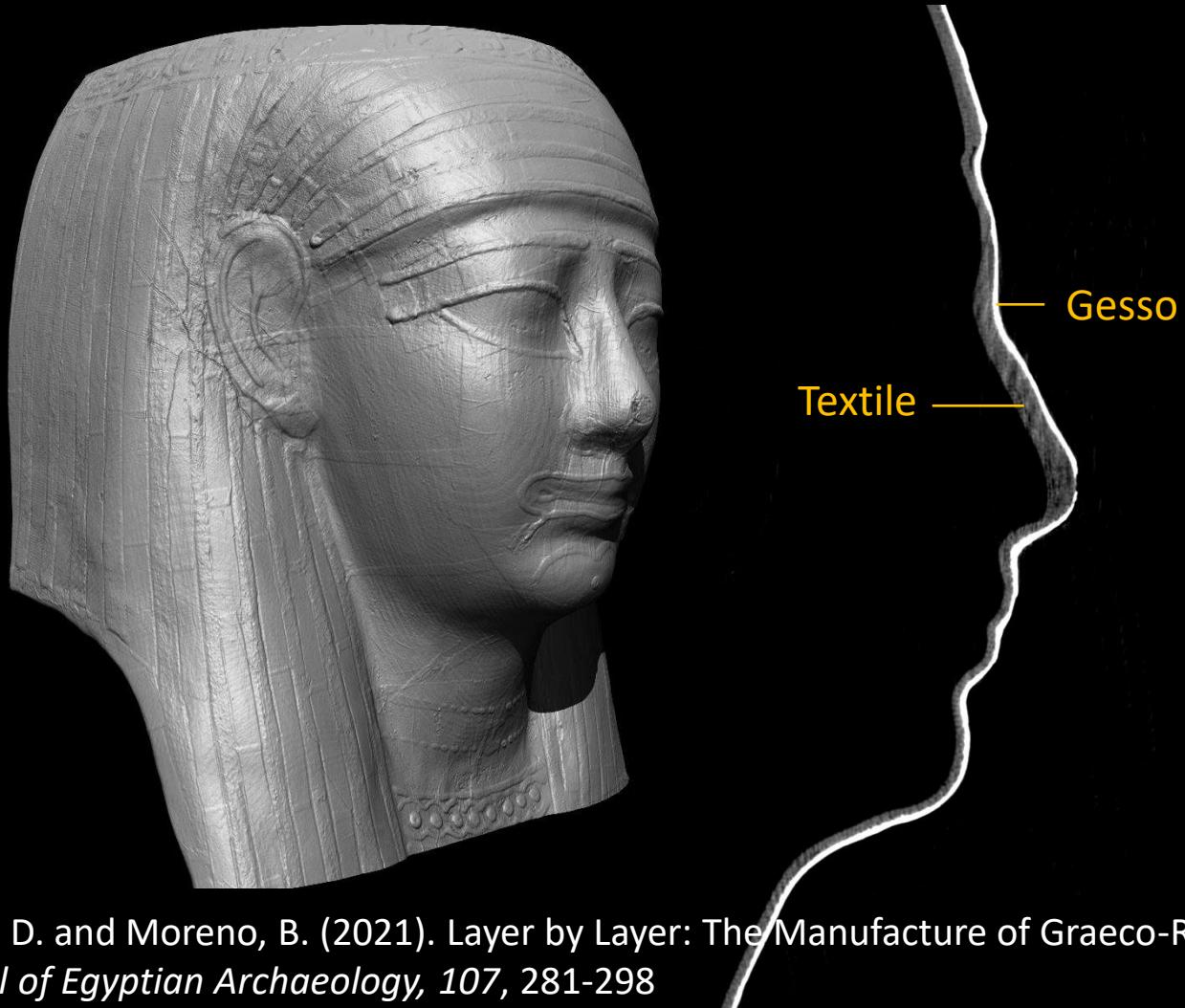
Egypt

Late Period (1st C BC – 1st C)
EA29472



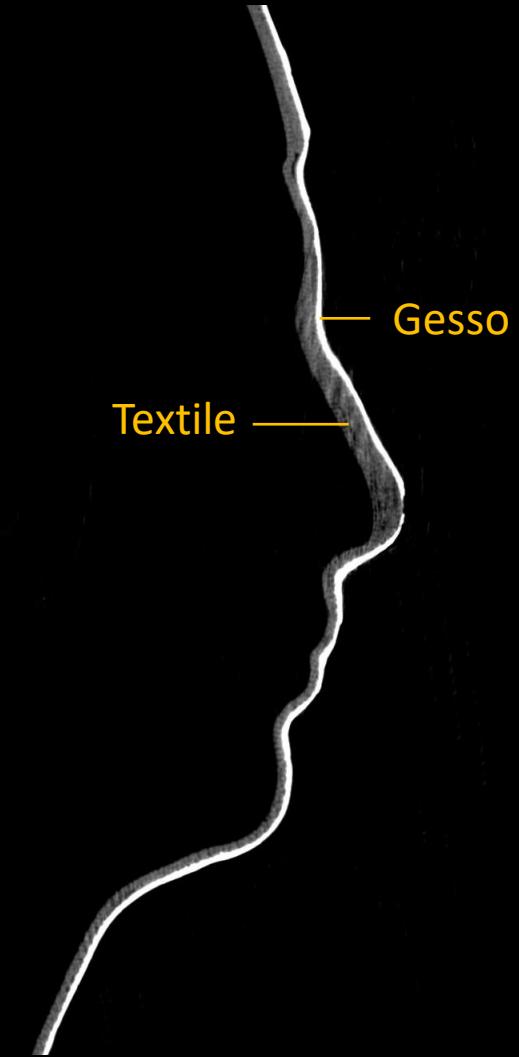
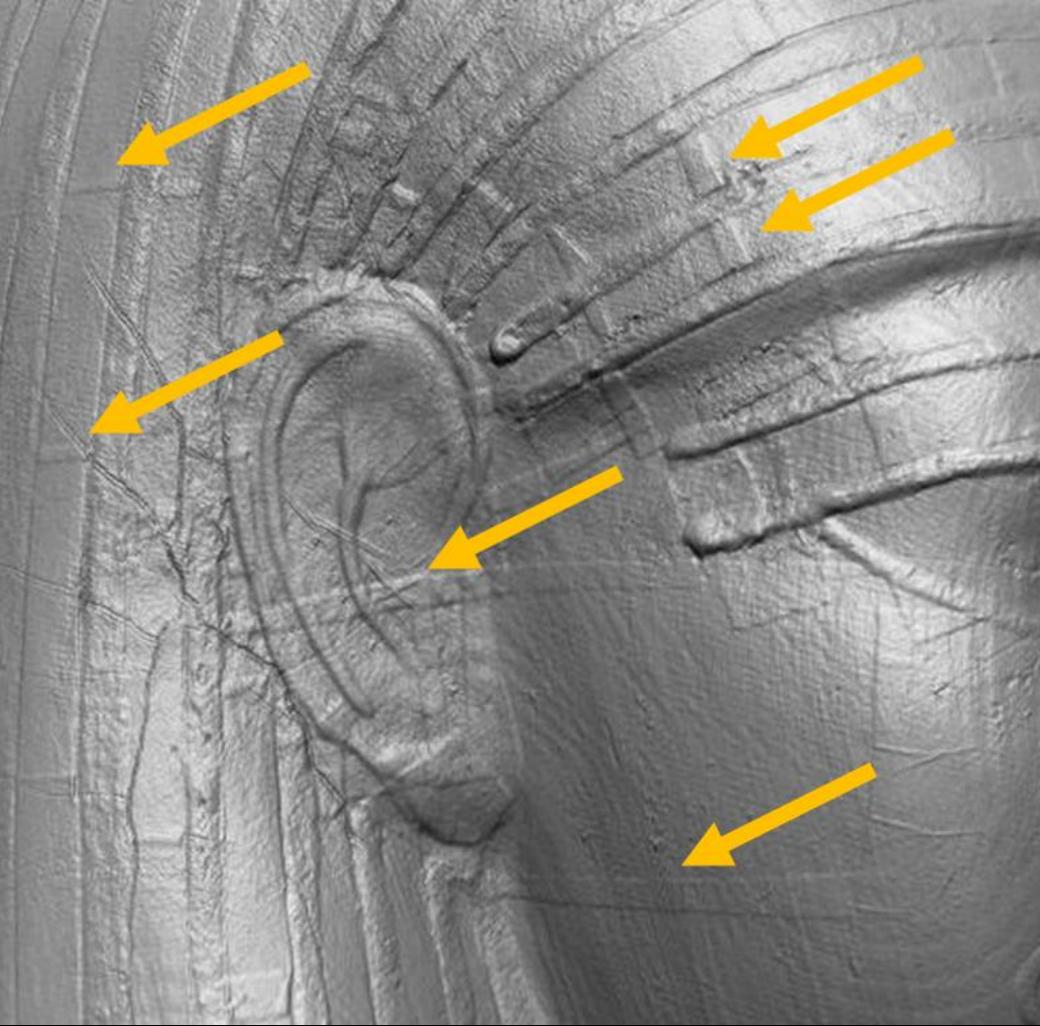
Vandenbeusch, M., O'Flynn, D. and Moreno, B. (2021). Layer by Layer: The Manufacture of Graeco-Roman Funerary Masks. *The Journal of Egyptian Archaeology*, 107, 281-298

The British Museum



Vandenbeusch, M., O'Flynn, D. and Moreno, B. (2021). Layer by Layer: The Manufacture of Graeco-Roman Funerary Masks. *The Journal of Egyptian Archaeology*, 107, 281-298

The





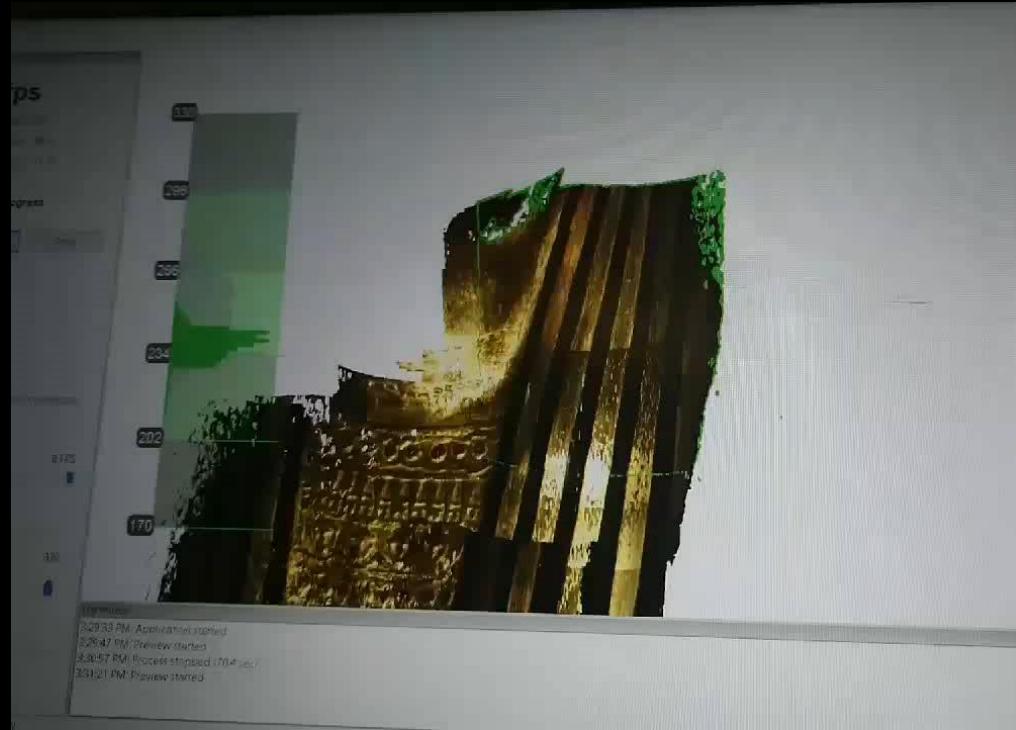
EA 29472
1st C BC – 1st C



EA 69020
c. 50 - 70

Vandenbeusch, M., O'Flynn, D. and Moreno, B. (2021). Layer by Layer: The Manufacture of Graeco-Roman Funerary Masks. *The Journal of Egyptian Archaeology*, 107, 281-298

Structured Light Scanning







ROOM SEARCH
PUSHBUTTON

Acknowledgements

- Caroline Cartwright (The British Museum)
- Nicole Reifarth (University of Tuebingen)
- Jonathan Taylor (The British Museum)
- Marie Vandenbeusch (The British Museum)
- Benjamin Moreno (IMA Solutions)
- Daniel Pett (The Fitzwilliam Museum)
- Amelia Knowlson (University of Leeds)

Software used

- VG Studio Max (Volume Graphics)
- ImageJ/Fiji -
<https://imagej.net/software/fiji/>



@danoflynn

Photogrammetry

Metashape walkthrough:
youtu.be/G-il2Neh928
(by Alicia Walsh)