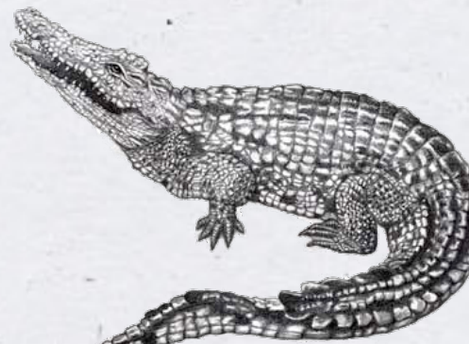
SUNOIKISIS DIGITAL CLASSICS 2016

SESSION 7: 3D SCANNING, IMAGING AND PRINTING

Eleni Bozia, Sara Gonzalez, Valeria Vitale

https://github.com/SunoikisisDC/SunoikisisDC-2016



OVERVIEW OF 3D IMAGING TECHNOLOGIES

Valeria Vitale, King's College London

Why using 3D imaging for ancient cultural heritage?

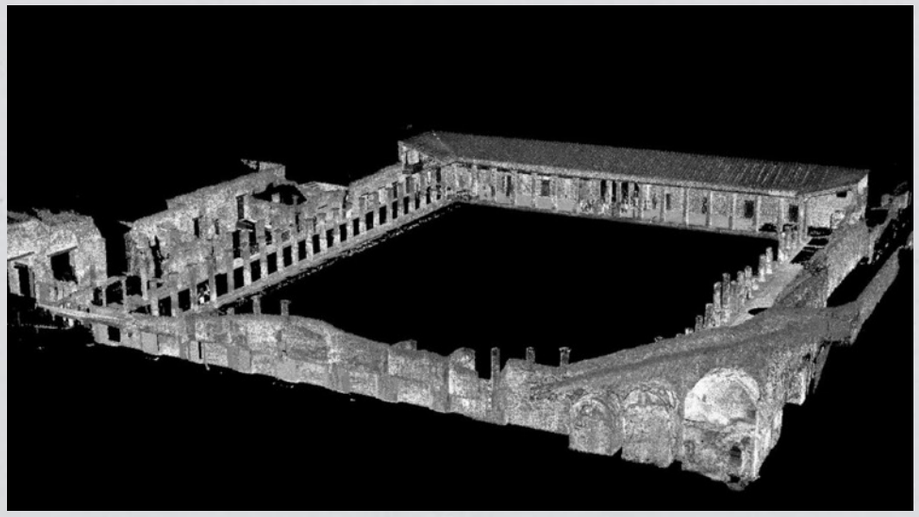
- Enhancement (for example: writing, engravings, scratches, tool marks, damages)
- Manipulation
- Virtual restoration and/or unification
- Testing hypotheses and develop variants
- Rescue archaeology
- Public engagement
- ...

A brief technological overview

Time of Flight Laser Scanners

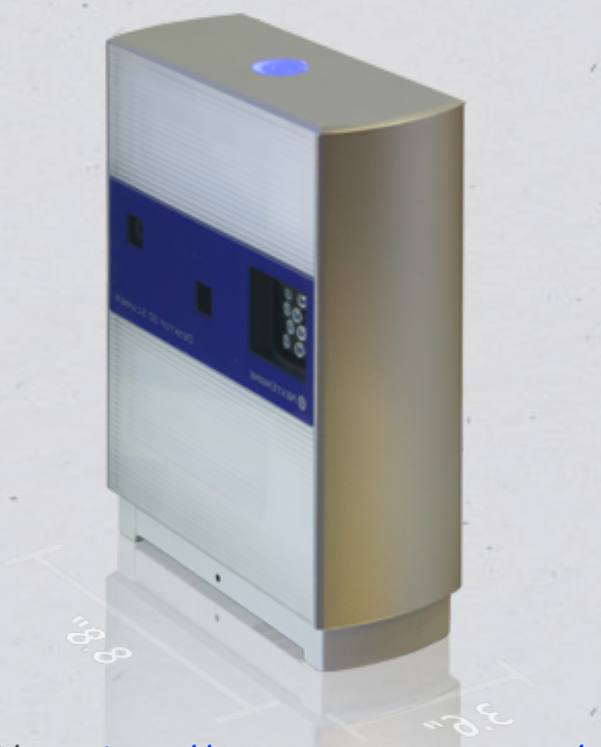
* Good geometric fidelity
* Suitable for large areas
* Expensive (60k$)
* Massive data set
* Slow process
* Not accurate on smaller artefacts

The Pompeii Quadriporticus Project



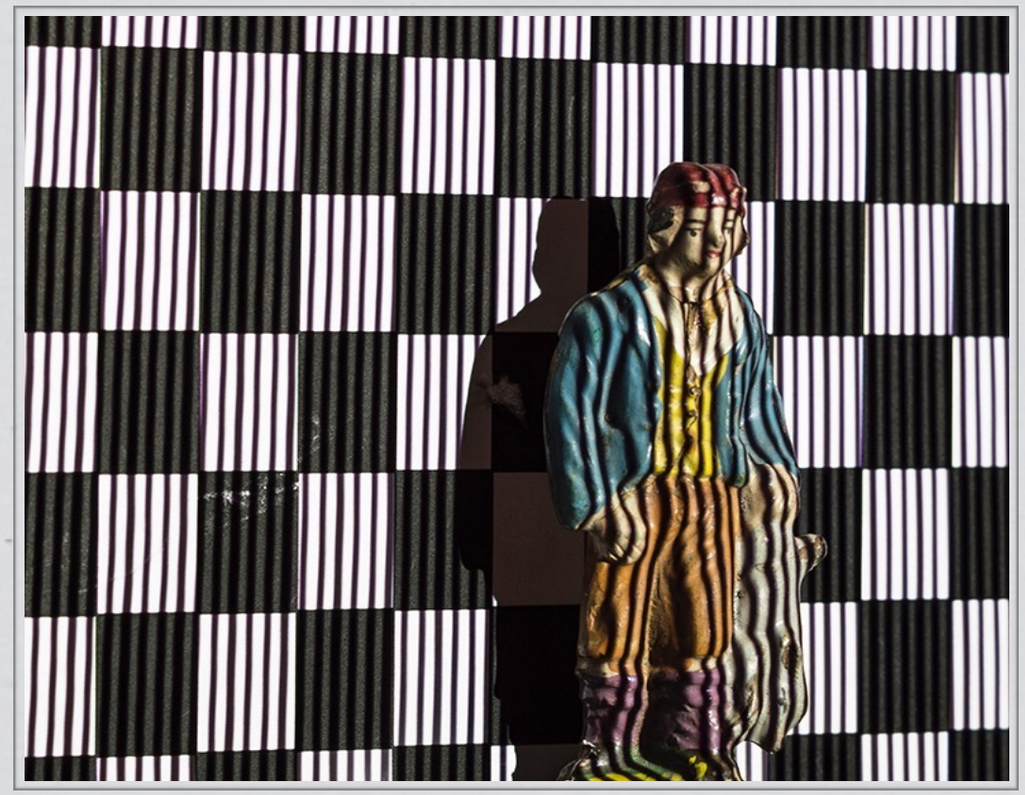
Laser Scanner Triangulation

- Cheaper than a ToF (but still between 12000 and 3000$)
- 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

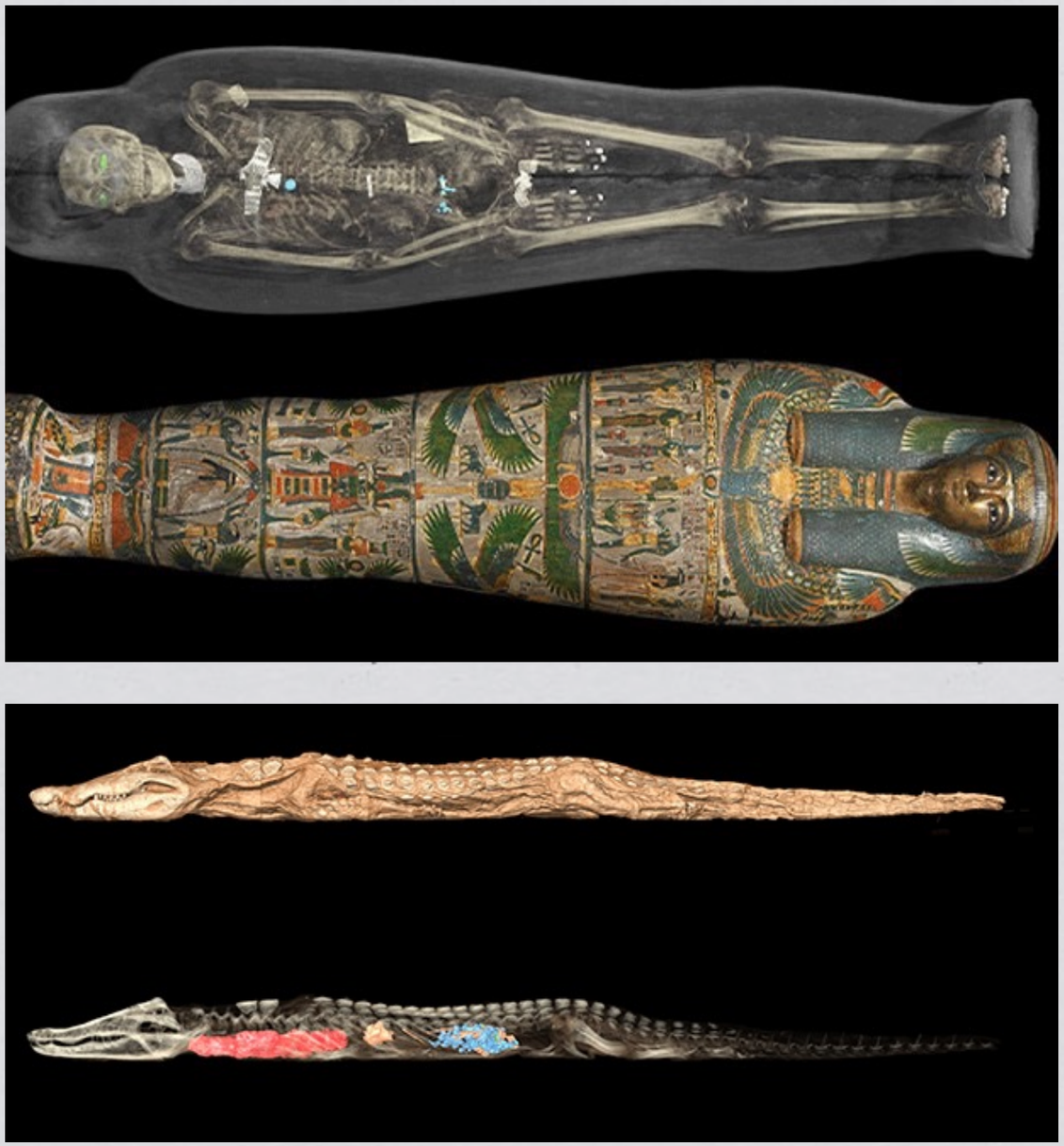


3D scanning by Structured Light using a mini (pico) projector coupled with the "3D scanning software" developed by D. Moreno and G. Taubin at Brown University School of Engineering.

http://chsopensource.org/2015/02/02/structured-light-3d-pico-projectors/

* 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)



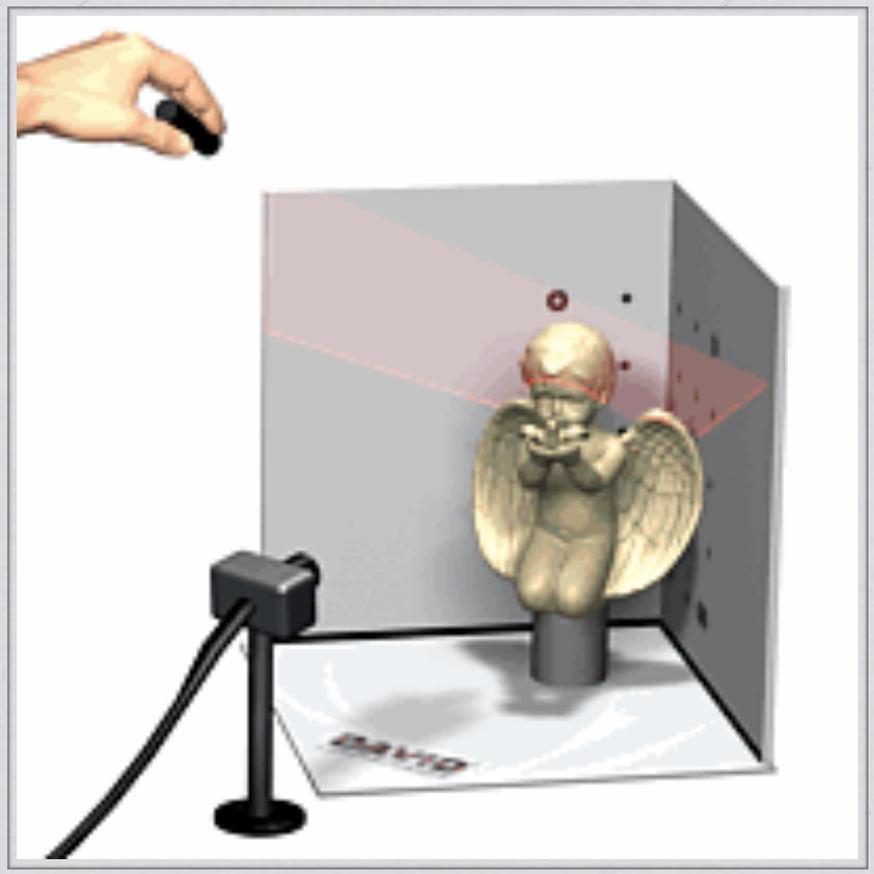
Images of CT scans used by the British Museum for the exhibitions "Ancient Lives, New Discoveries" and "Scanning Sobekh".

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

Low cost options

DIY Laser Scanner

- Cheap starter kit (even cheaper if you DIY)
- Good on small artefacts (1 to 40 cm)
- Portable
- Needs calibration
- Needs studio setup



David 3D Scanner

http://www.david-laserscanner.com/

Depth Map Sensor

Hardware

* Kinect for PC

* Asus Xtion

(both have pros and cons)

CREDITS: ANDREW MC WILLIAMS HTTP://JAHYA.NET/

Software

* Reconstruct me

* Skanect

* Volumental

CREDITS: MATTHEW FISHER HTTP://GRAPHICS.STANFORD.EDU/~MDFISHER/KINECT.HTML
HTTP://WWW.YOUTUBE.COM/WATCH?V=NVVQJXGYKCU&FEATURE=PLAYER_EMBEDDED

Photogrammetry

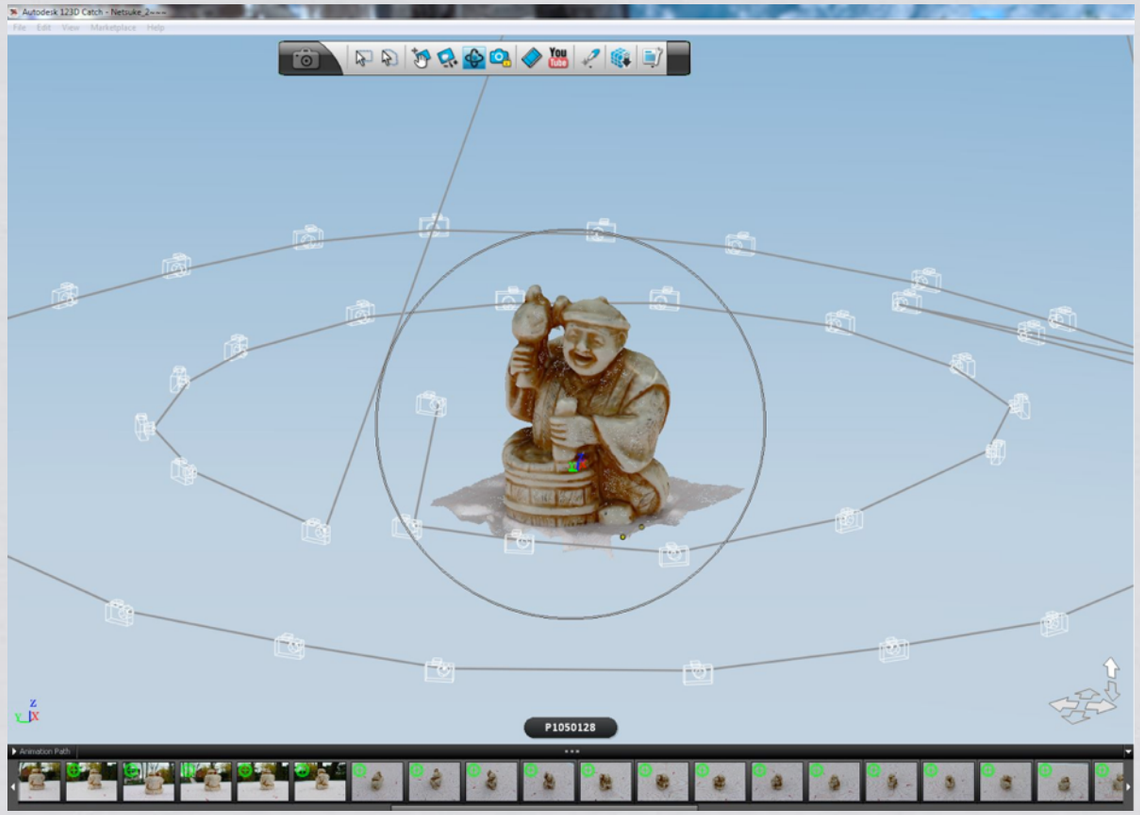
* Based on triangulation
* Cheap
* Easy to learn
* Portable equipment
* 3D mesh as an output

Agisoft Photoscan

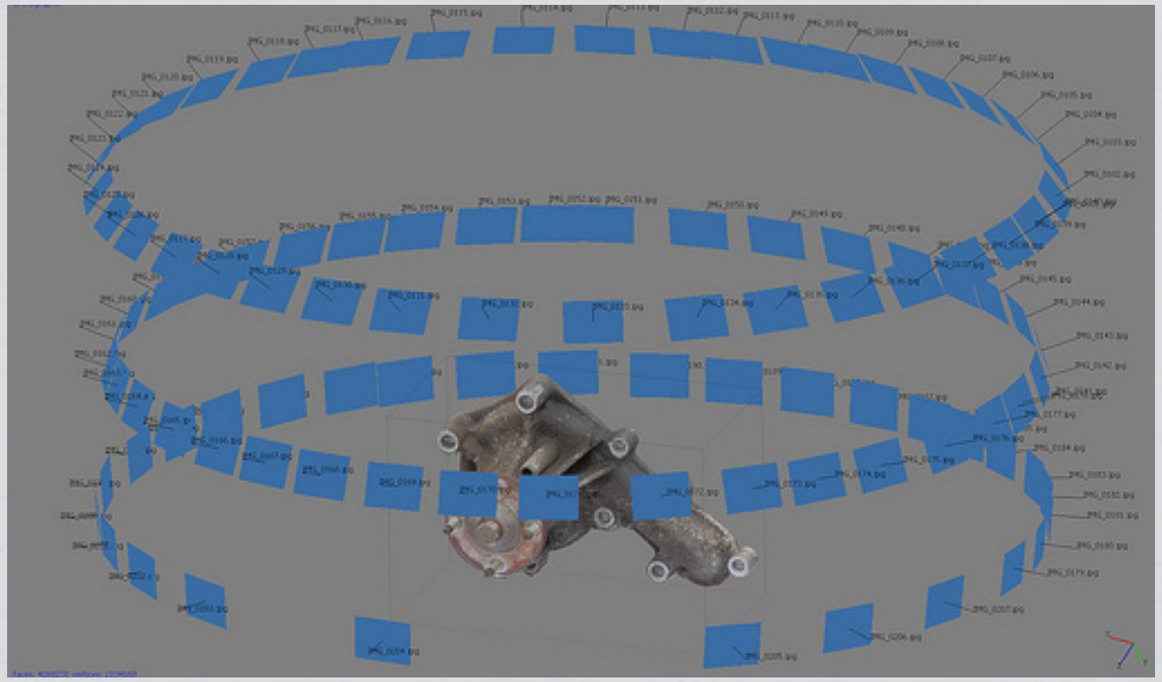
http://www.agisoft.com/

Autodesk123D catch

http://www.123dapp.com/catch



Capture with 123D catch http://www.tcproject.net



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

Structure from Motion

* Similar to Photogrammetry
* Cheap
* Relatively simple to use (but requires more IT skills)
* Accurate colour information
* Long processing time
* Output in point cloud

Visual SFM

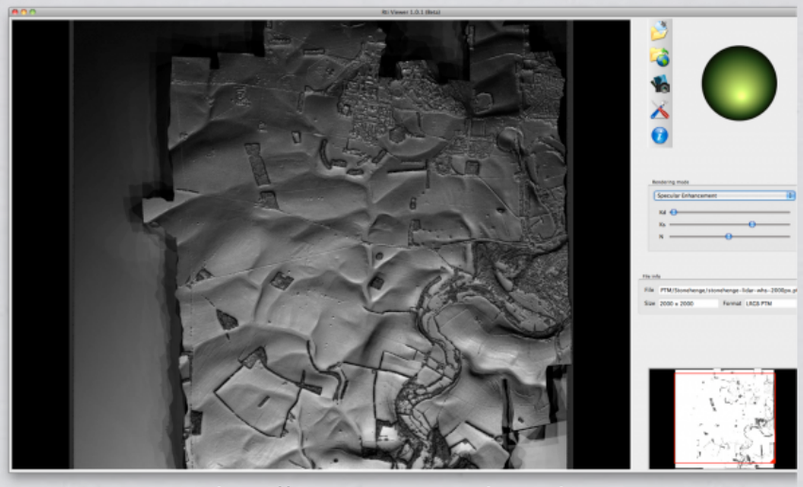
http://ccwu.me/vsfm/

http://www.praehistorische-archaeologie.de

Reflectance Transformation Imaging (RTI)

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

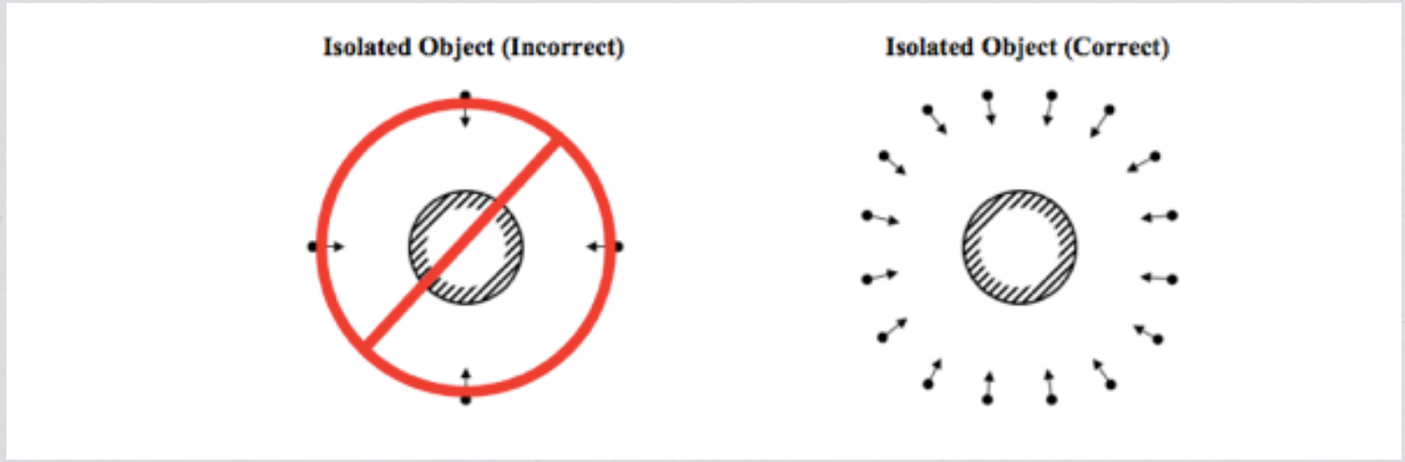
www.topoi.org

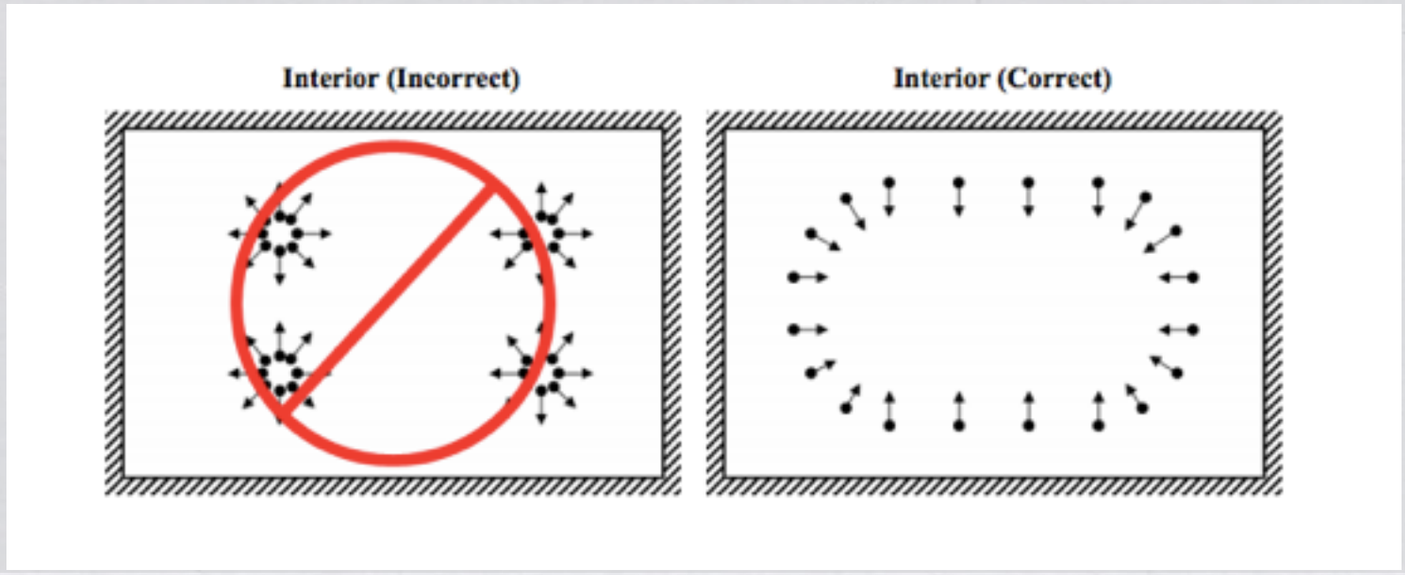


http://www.wessexarch.co.uk

Exercise: digital imaging of an artefact

Photogrammetry Shooting Tips





From Agisoft Photoscan user's manual

Photogrammetry Shooting Tips

- POSITION: The target **must** remain in the same position.
- LIGHT: The target should be evenly lit. Avoid long shadows. Including your own!
- FOCUS: The target must be on focus. Delete any blurred images before processing.
- SURFACE: Each part of the target should be in at least two photographs. Ensure 40, 50% overlap (horizontally and vertically) when taking subsequent pictures. Check for occluded areas. Try different angles. Add close-ups after you have imaged the main mass.

Limits

* Transparent surfaces
* Glossy, shiny surfaces
* Repetitive, featurless surfacese
* Very thin, criss-crossing surfaces (hair, leaves)
    * (Claud-based processing: performance and copyright issues)

It sometimes helps to:

* Make the surface opaque
* Add extra marks to help the software identifying features

Follow the step-by-step instructions in the handout to complete the exercise. The list of software and all the information you need are available online on the SunoikisisDC 2016 github

Documentation

* Date and time of the photoshoot
* Camera and lights
* Positions of the camera during the photoshoot
* Software and hardware
* Compression and Post-editing

THANK YOU FOR YOUR ATTENTION

valeria.vitale@kcl.ac.uk

@nottinauta