Are Photogrammetry and 3D Scanning real alternatives to 3D modelling for Virtual Heritage applications?

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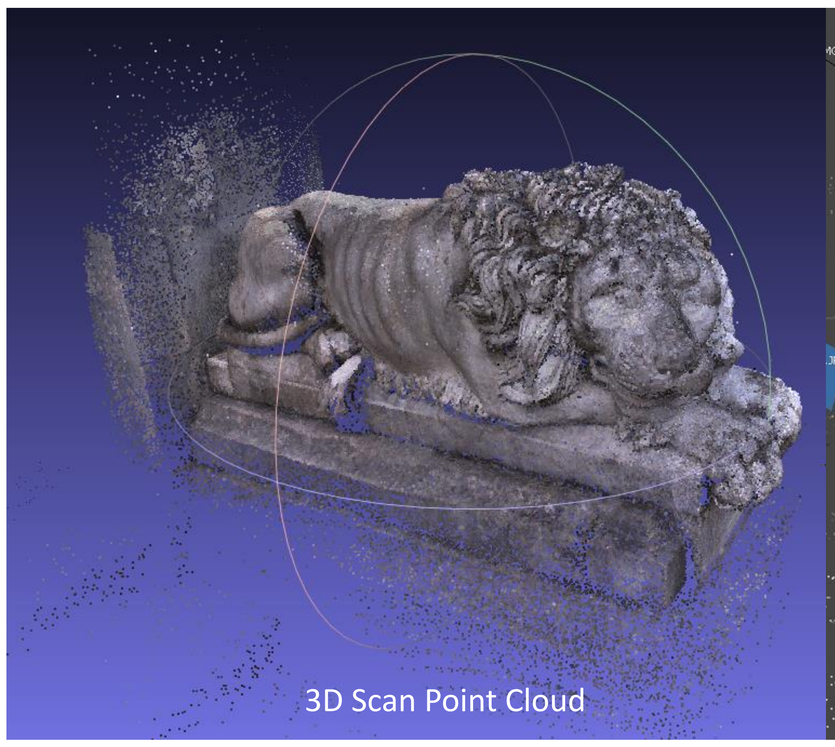
Motivation: To reduce the modelling effort in the creation of Virtual Reality environments used to engage the public with Cultural Heritage

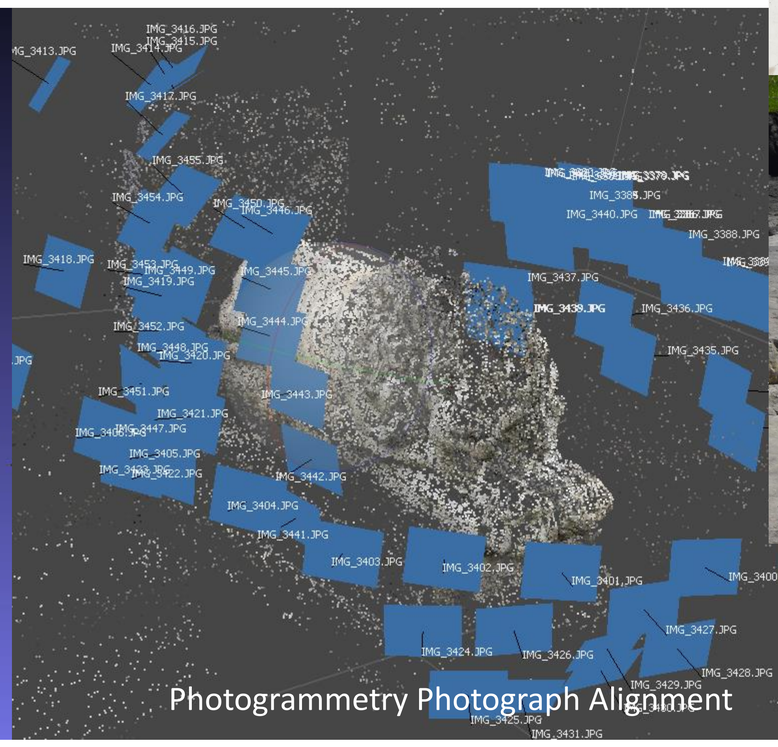
- Comparison of Photogrammetry and 3D scanning for the creation of low polygon 3D models
- A practical investigation into how Photogrammetry and handheld 3D scanners help in the creations of realistic low polygon 3D models?

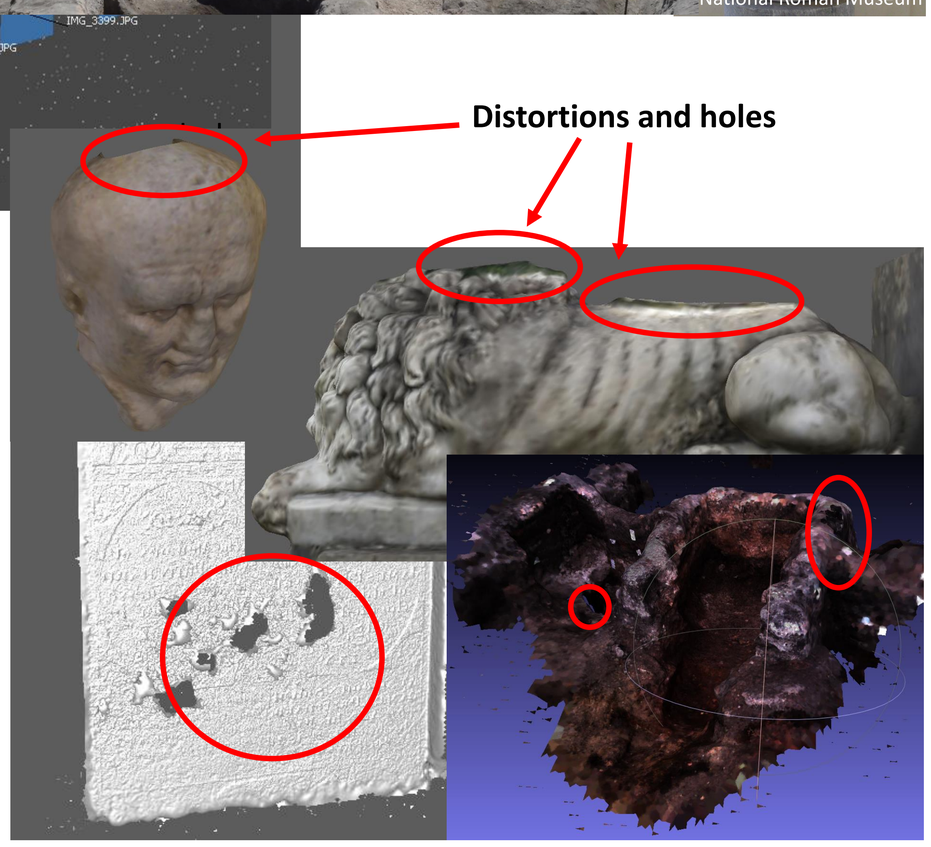
3D Scanning:
Hardware: Faro Freestyle Handheld 3D scanner
Software: **Scene**, **Meshlab**

Photogrammetry:
Hardware: Nikon D800e, iPhone
Software: **Agisoft Metashape**, **Autodesk ReCap**, **MeshRoom**

Test objects: A range of objects and ground features were chosen from about 20 cm up to 8m.


3D Scan Point Cloud


Photogrammetry Photograph Alignment



Data Capture:

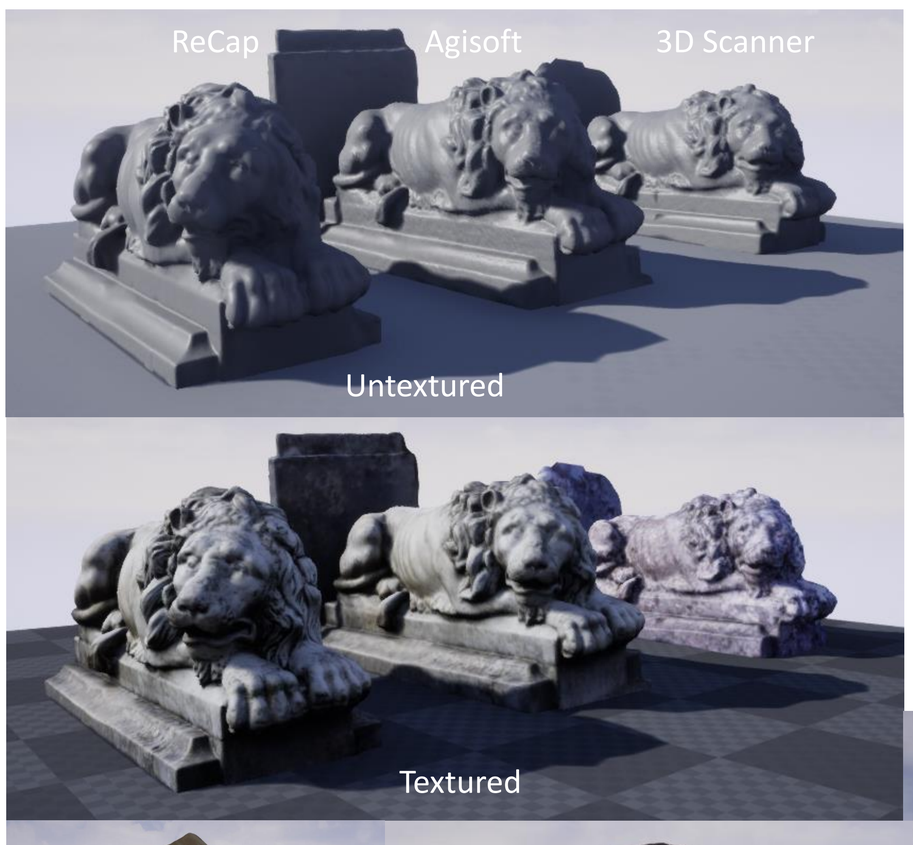
- Roughly equivalent time for both methods, but it is slightly quicker using the cameras
- Taking more photographs and longer scanning times improves accuracy of models
- Bright sunshine was a problem for both methods
- Stitching together multiple scans can lead to inaccuracies

Processing:

- The scanner software was relatively quicker to process
- Photogrammetry with large numbers of photographs takes a prohibitively longer time
- Some incorrect face normals can be generated from point clouds
- There may be problems of interpreting edges from photographs
- More lifelike textures are generated using photogrammetry

Creating Game Ready models

- The polygon count of 3D models has to be low to be imported into a game engine
- To reduce polygons without losing too much detail a combination of **Autodesk Maya** and **Pixologic ZBrush** were used
- The **ZRemesher** tool retopologized the mesh to reduce the polygon count to a usable level and the **projection** tool projected the detail and the texture onto the new low polygon model



Provisional Conclusions:

- Depends on the level of accuracy required
- Detailed game meshes can be generated from Handheld 3D Scanners but that is not their primary purpose
- Photogrammetry is surprisingly accurate enough to reproduce relatively fine detail
- Both methods require time consuming procedures to create suitable models
- Photogrammetry and 3D scanner models will be more accurate than can be created by skilled 3D modellers, but there may be little difference in time - A hybrid approach is recommended to increase accuracy of 3D modelling


Examples of the processed models within game engines