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

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

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

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