

**Museums of the North West
Photogrammetry Hub: Building
Virtual 3D Futures**

Creating 3D Models with Agisoft Metashape v.1.7.2

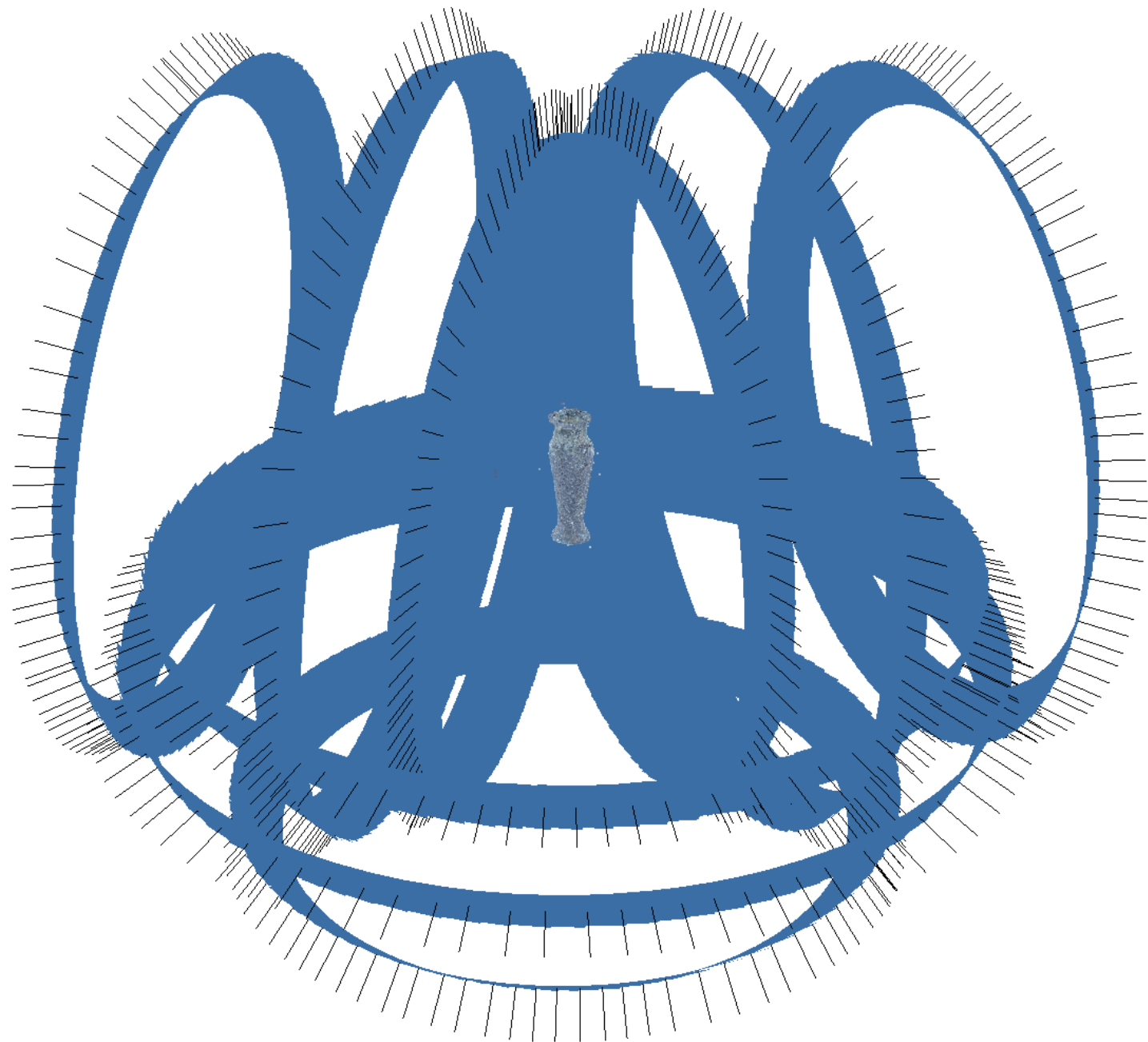


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Please note that this guide was produced for Agisoft Metashape 1.7.2. While the overall workflow will apply to other versions, certain settings may change and your results may vary

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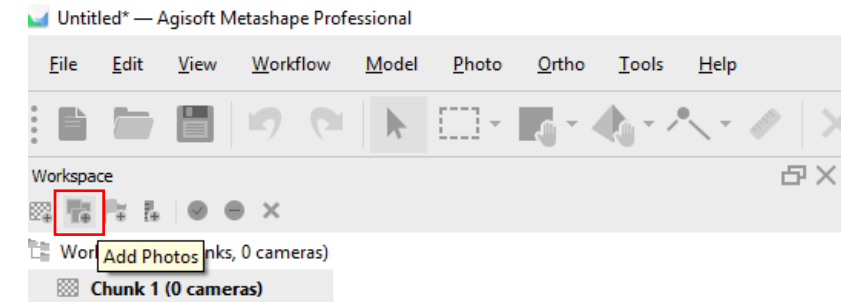
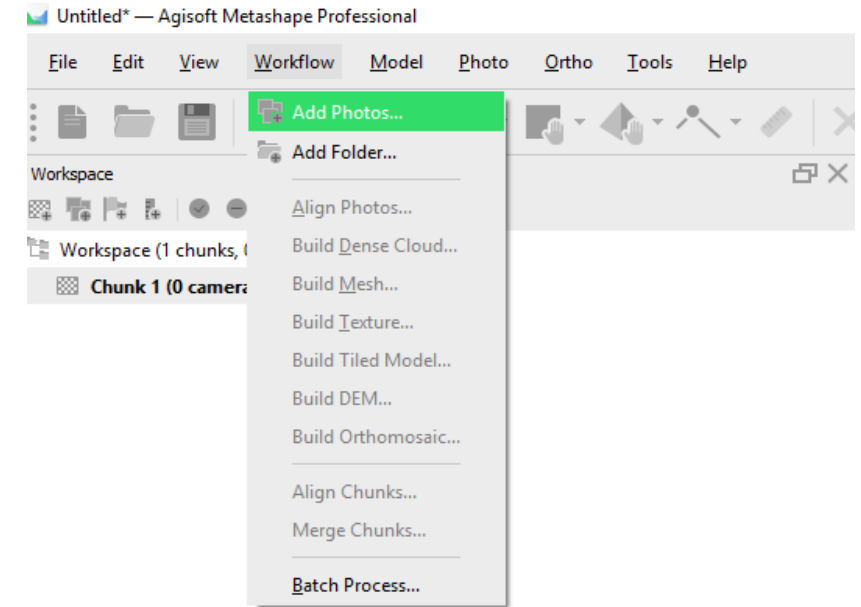


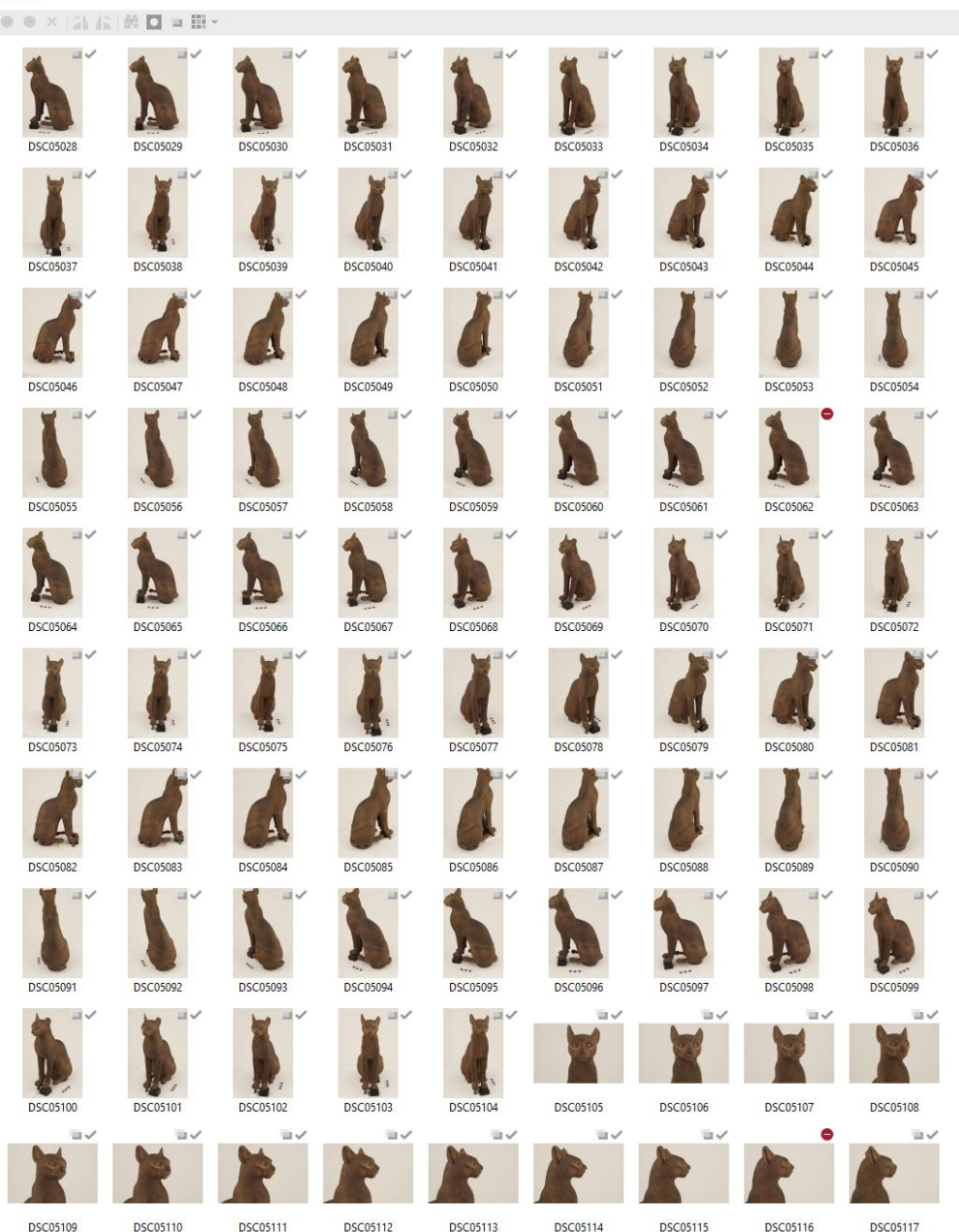
1. Importing Photos

There are several ways to do this:

1. Select Add Photos... command from the Workflow menu
2. Click Add Photos toolbar button on the Workspace pane
3. Right click the chunk, go to the Add option, select Add Photos...
4. Drag and drop selected images directly into the chunk

Once you have selected Add Photos... (options 1-3), a dialogue box will open, find your photos and select the photos that you wish to process





1a. Importing Photos: Refining Selection

- Check through images for motion blur or unwanted photos
- Remove unwanted images
 - Right click the selected image(s) and select 'remove cameras', or click the remove camera icon in the photos pane
- Alternatively, disable the image
 - Click the disable cameras icon in the photos pane or right click the photo and select the 'disable cameras' option
 - Disabled photos are indicated by a red circle next to the thumbnail

1a. Importing Photos: Refining Selection



Image quality assessment

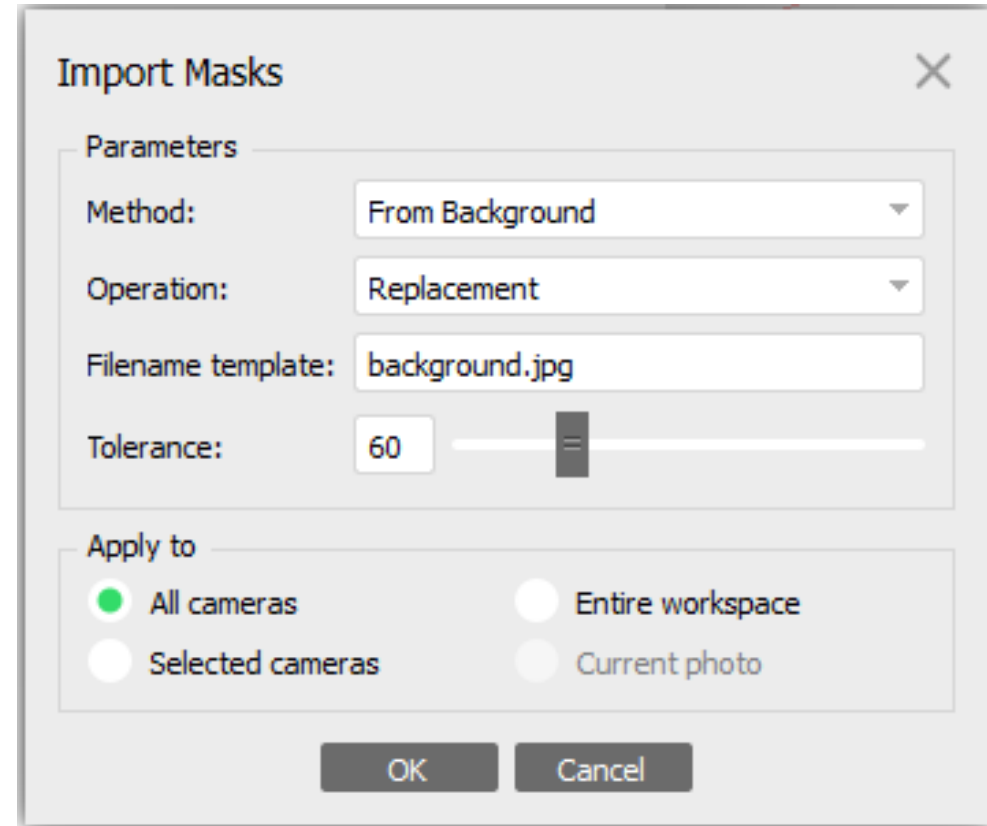
The image quality assessment tool in Agisoft looks for sharpness in an image relative to other images in the dataset

1. Switch to the detailed view in the Photos pane by clicking the Change View icon in the photos icon bar
2. Select the photos to analyse (ctrl+a to select all)
3. Right click on the selected photo(s) and select 'Estimate Image Quality' option
4. Once the analysis is done, a number indicating estimated image quality value will be displayed in the Quality column on the Photos pane. Sort lowest to highest and click through the low scoring images choosing which to disable and which to keep

Note that this assessment isn't perfect, especially where the subject of the photograph has a surface that makes it difficult for the software to identify 'sharpness'

2. Import Masks: Agisoft Auto Creation (Background)

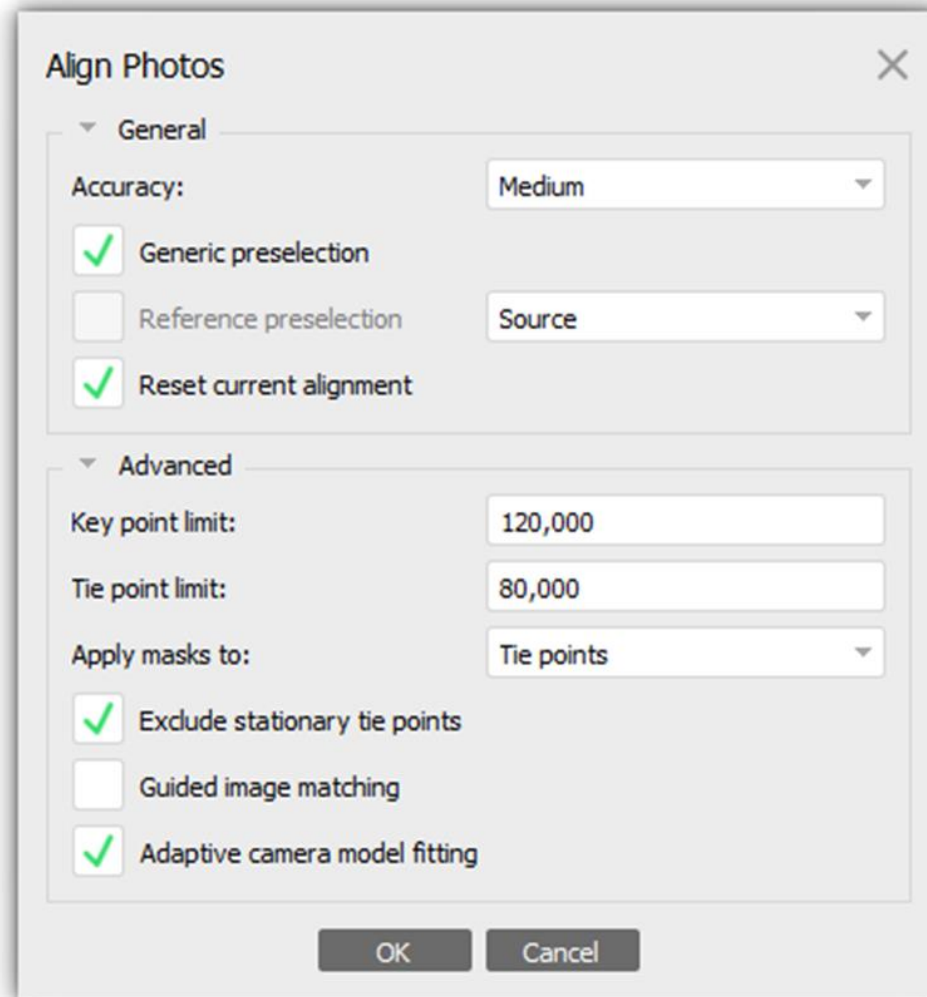
- You will need a photo of your background without the object present OR a black jpg file with the same resolution as your photos. Name this file background.jpg
- Select all the photos, right click, go to the masks option and select import masks
- The 'Import Masks' dialogue will pop up, enter the following parameters:
 - Method: From Background
 - Operation: Replacement
 - Filename Template: background.jpg
 - Tolerance: This will depend on the contrast between your object and background. If your masks cut into your object, raise the tolerance. If your masks include too much background, drop the tolerance. A good starting point is 50
 - Apply to: All cameras or Selected Cameras



2. Import Masks: Manual Masking

Manual Masks in Agisoft

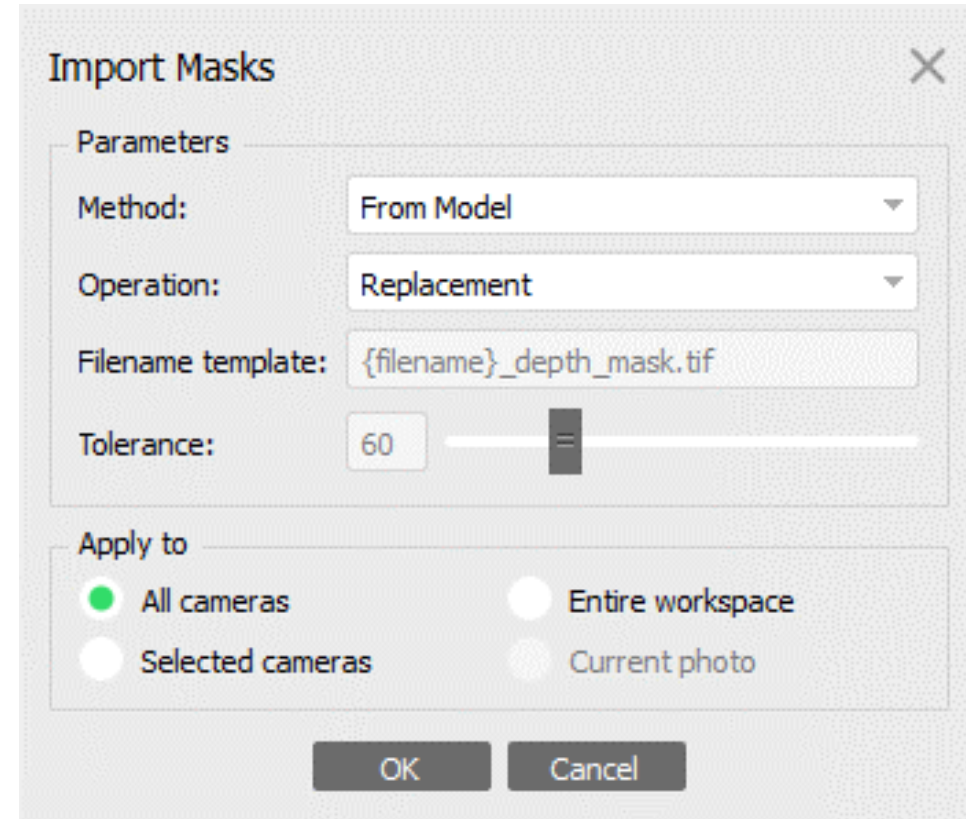
- Create 3-4 masks by hand, leave the other photos unmasked
- Once you have masked 3-4 photos (ideally, they should show different sides of the object), run the alignment with the following parameter:
 - Apply Masks To: Tie Points
- This means that certain tie points are excluded from the alignment procedure. So, if an area is masked at least on a single photo, key points in other photos picturing the same area will also be excluded during alignment



2. Import Masks: Masks from Model

Masks from Model

- Align your model without masks and clean up the sparse cloud (following instructions in the Optimisation section of this guide)
- Build your mesh using the 'from sparse cloud' option
- Select all the photos, right click, go to the masks option and select 'Import Masks'
- The 'Import Masks' dialogue will pop up, enter the following parameters:
 - Method: From Model
 - Operation: Replacement
 - Apply to: All cameras or Selected Cameras



Import Masks

Parameters

Method: From Model

Operation: Replacement

Filename template: {filename}_depth_mask.tif

Tolerance: 60

Apply to

☒ All cameras ☐ Entire workspace

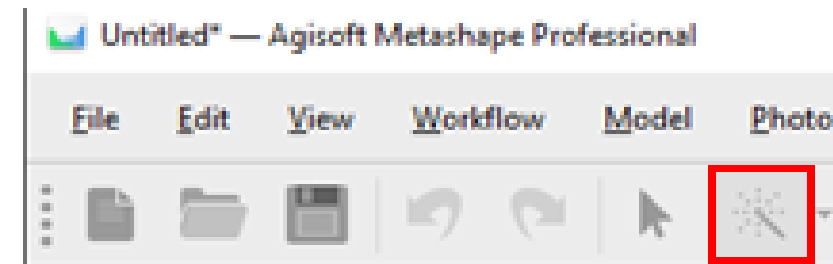
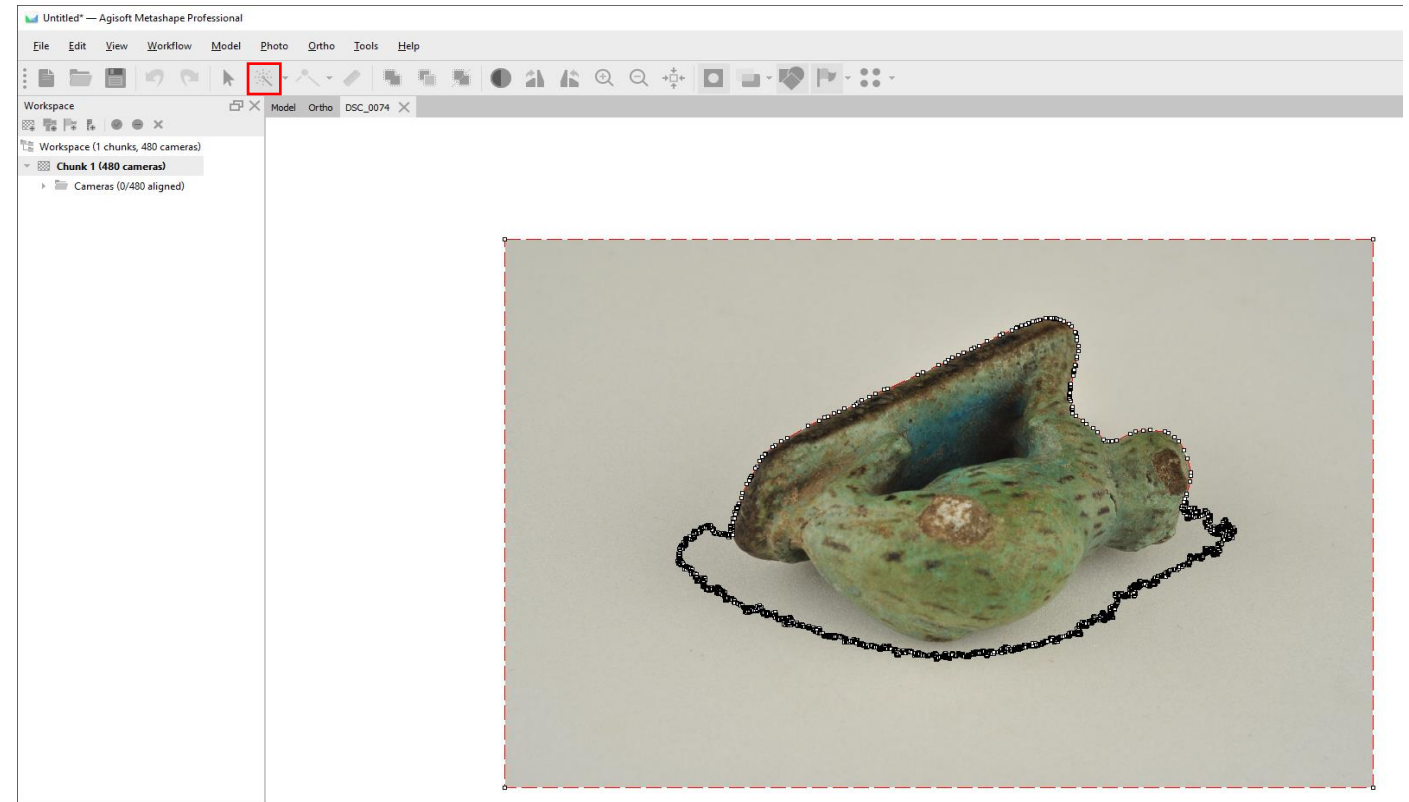
☐ Selected cameras ☐ Current photo

OK Cancel

2a. Masking: Refine Masks

Manual Masks in Agisoft

- Double click on a photo in the photos pane to view full size in the model pane
- Use the selection tool to create/edit a mask
- There are different types of selection tool
- The magic wand selection tool will select areas of similarly coloured pixels
- Once you have selected an area that you wish to mask out, right click on that area and select 'Add Selection'
- This will add the selected area to the mask
- If you accidentally mask out some of the subject, choose 'Subtract Selection' instead of add (or ctrl+z to undo)





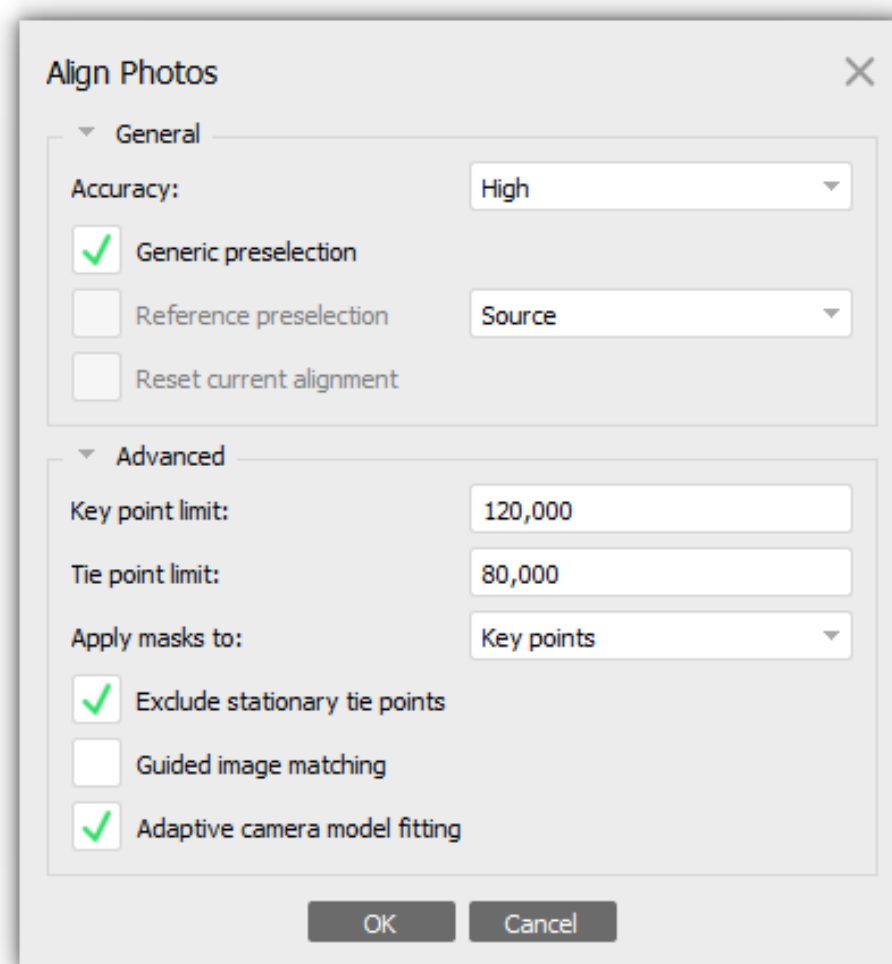
2b. Masking: Refine Masks

Important Note

- Masks sometimes have an influence on later model building stages and cause complications in depth maps generation
- Normally, this is not an issue, but if you are having issues with your depth maps and mesh, try resetting your masks after the alignment before running these stages

3a. Alignment: Running the Process

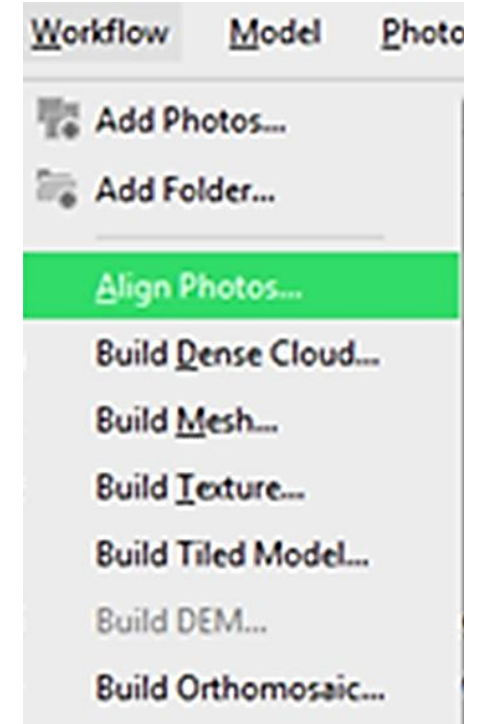
- Go to the Workflow menu, select the Align Photos option
- The 'Align Photos' dialogue will pop up, enter the following parameters:
 - **Accuracy:** Lowest/Low/Medium/High/Highest
 - Higher accuracies will take longer to process
 - **Generic Preselection:** Selected
 - **Reference Preselection:** Unselected
 - **Reset Current Alignment:** Unselected
 - Or selected if you wish to re-run an alignment
 - **Key Point Limit:** 120,000
 - **Tie Point Limit:** 80,000
 - If your alignment is taking too long, reduce these numbers (e.g. to 40,000 and 10,000)
 - **Apply Masks To:** Key Points
 - Unless using Manual Masking Method, then select Tie Points
 - **Exclude Stationary Tie Points:** Selected
 - **Guided Image Matching:** Unselected
 - **Adaptive Camera Model Fitting:** Selected



The 'Align Photos' dialog box is shown with the following settings:

- General**
 - Accuracy: High
 - ☒ Generic preselection
 - ☐ Reference preselection (Source)
 - ☐ Reset current alignment
- Advanced**
 - Key point limit: 120,000
 - Tie point limit: 80,000
 - Apply masks to: Key points
 - ☒ Exclude stationary tie points
 - ☐ Guided image matching
 - ☒ Adaptive camera model fitting

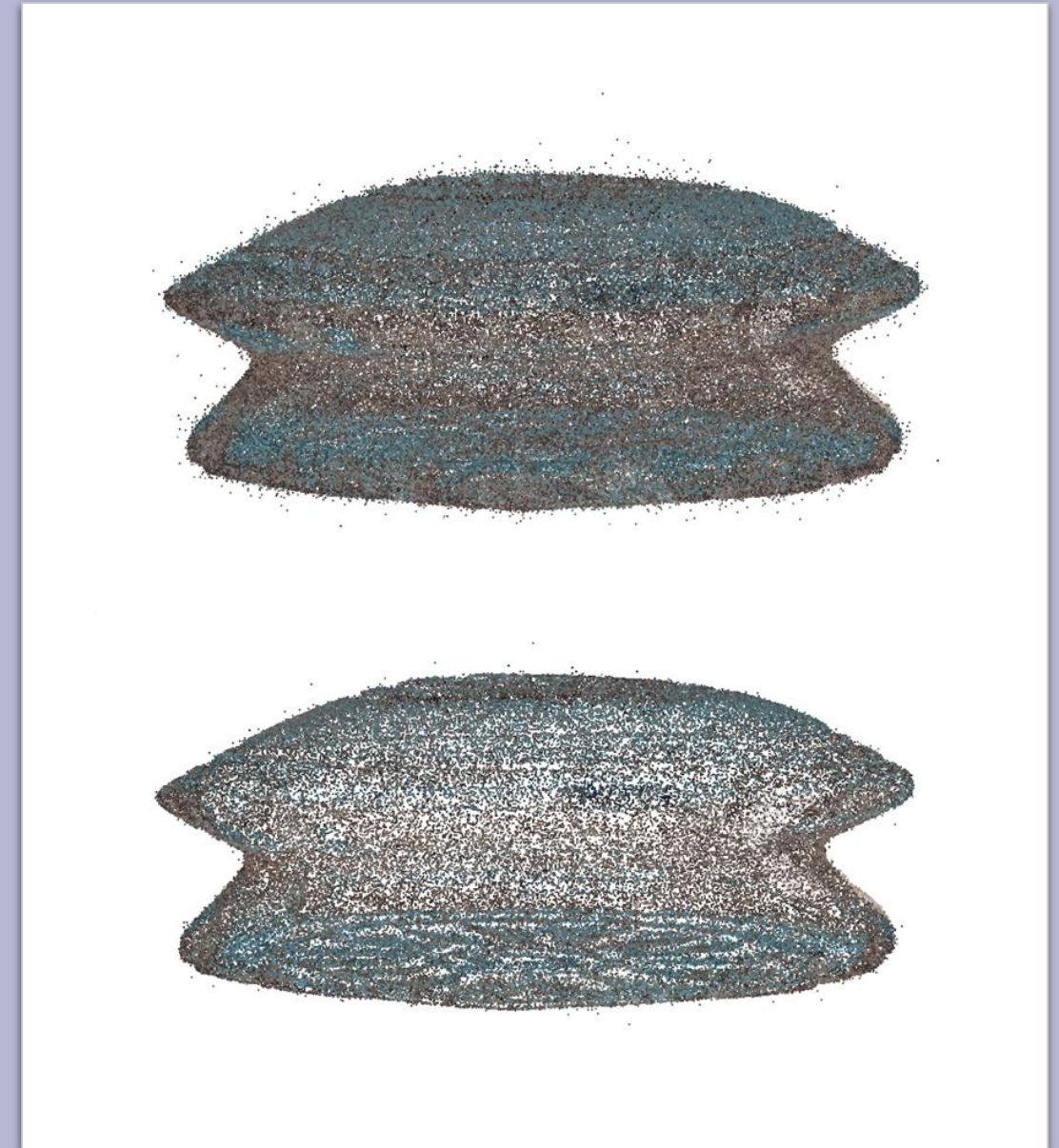
Buttons: OK, Cancel



3b. Alignment: Cleaning the Sparse Point Cloud

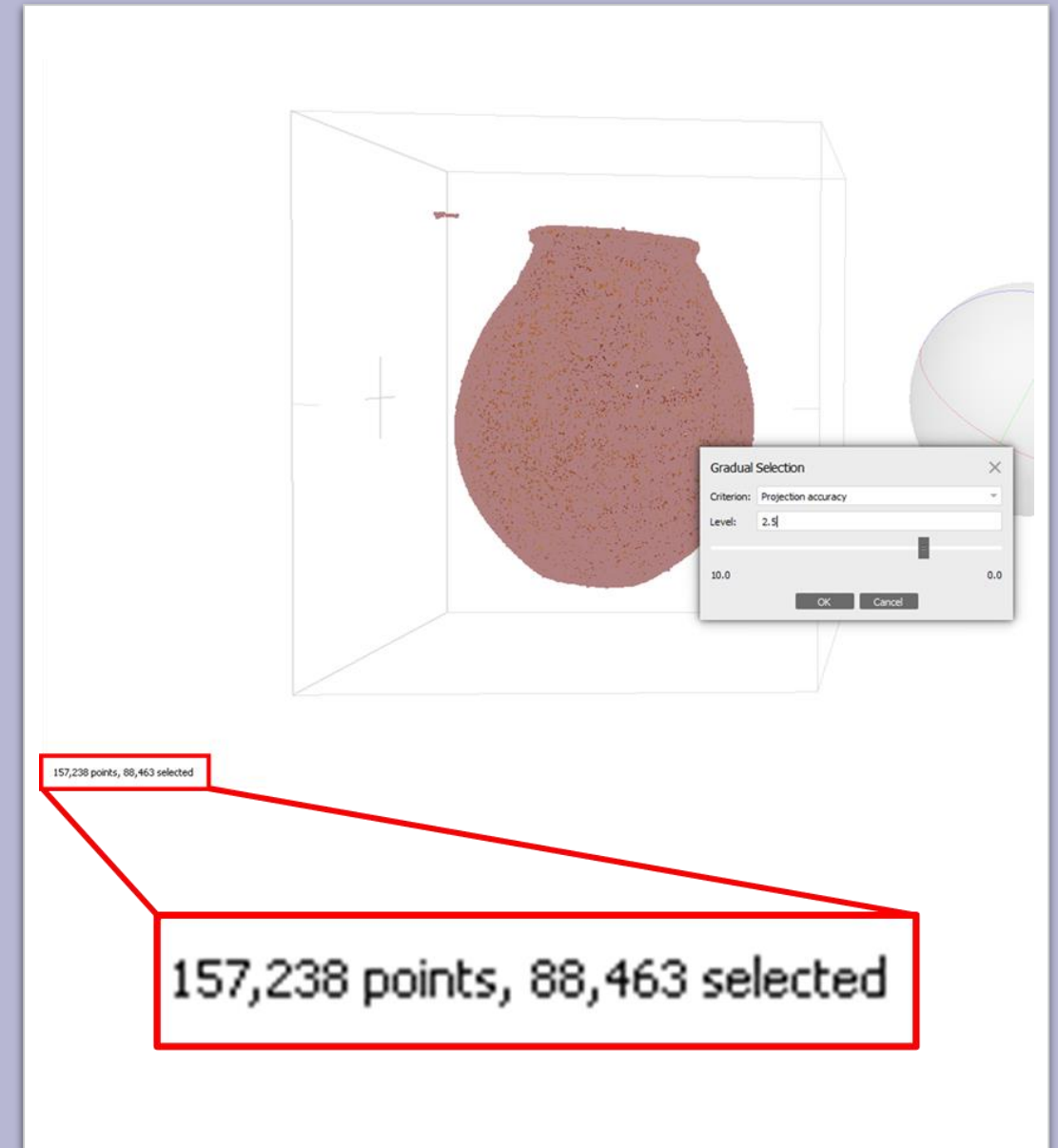
1. Duplicate your chunk as a backup
2. Go to the Model menu and select Gradual Selection
 - Model > Gradual Selection
3. Reconstruction Uncertainty – Level 50
 - Select OK and delete the selected points (in pink)
 - Optimise Cameras (See slide 15)

Sparse point cloud cleaning is a very subjective process and often isn't necessary



3b. Alignment: Cleaning the Sparse Point Cloud

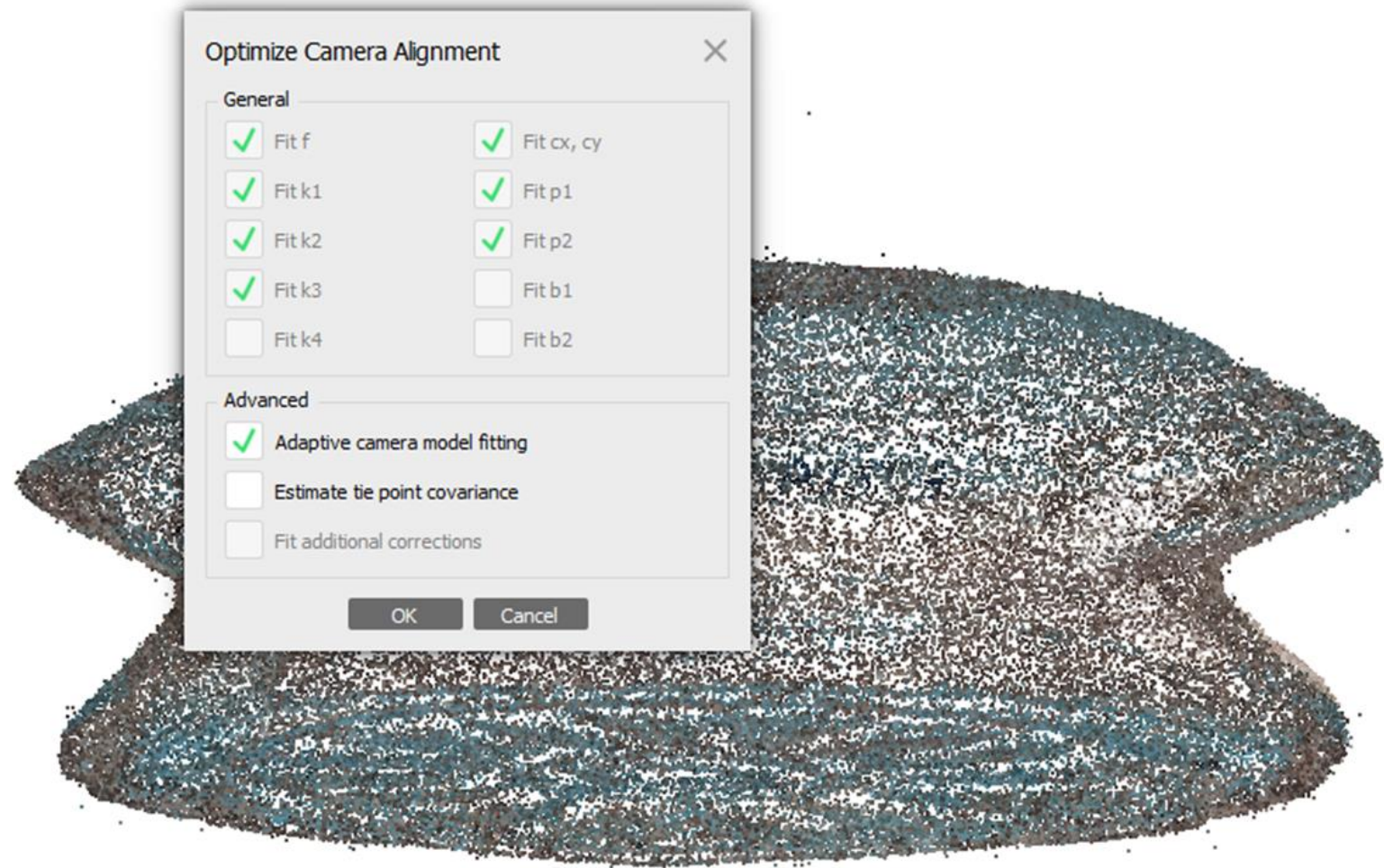
- Make sure that you don't delete too many points
 - You will see the number of points being selected in the bottom left of the model pane
 - Try to keep at least 50% of the points that you started with
- If you deleted a lot of points you might get a "Some cameras have insufficient number of projections and will be reset. Continue?" If you get this popup, click "yes" and the program will try to reset the photos based on the remaining points.
- If you find that you have 'over-cleaned' your sparse cloud, go to your back up chunk (you should have duplicated the initial chunk before this process) and only use one of the gradual selection criteria



3c. Alignment: Optimise Cameras

Camera optimisation uses the existing tie points (which have been refined using the Gradual Selection criteria) to refine the camera orientations and triangulated tie point positions.

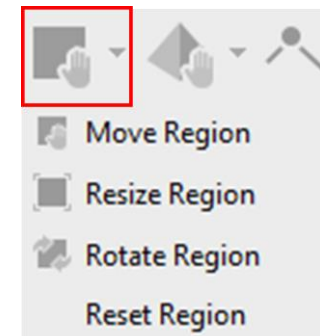
1. Go to the tool menu and click on 'Optimise Cameras...'
 - Tools > Optimise Cameras
2. In the optimise cameras dialogue box, select 'Adaptive Camera Model Fitting'
 - This automatically selects the relevant camera parameters for us
3. Select OK, the optimisation will begin



3d. Alignment: Bounding Box

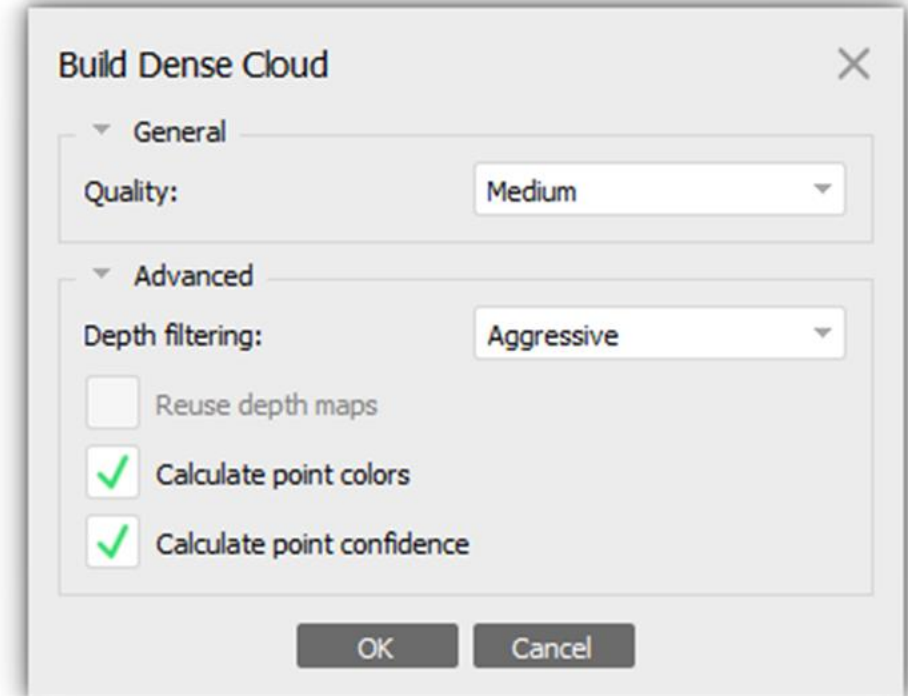
Only the area inside the bounding box will be processed. We must check and, if necessary, adjust the bounding box before continuing with the processing

1. To view the bounding box, go to the menu Model > Show/Hide Items > Show Region
2. Rotate your sparse point cloud, ensure that all areas you wish to process are inside the box
3. If the box needs adjusting, use the Resize Region, Move Region and Rotate Region toolbar buttons.



4a. Dense Point Cloud (Optional): Running the Process

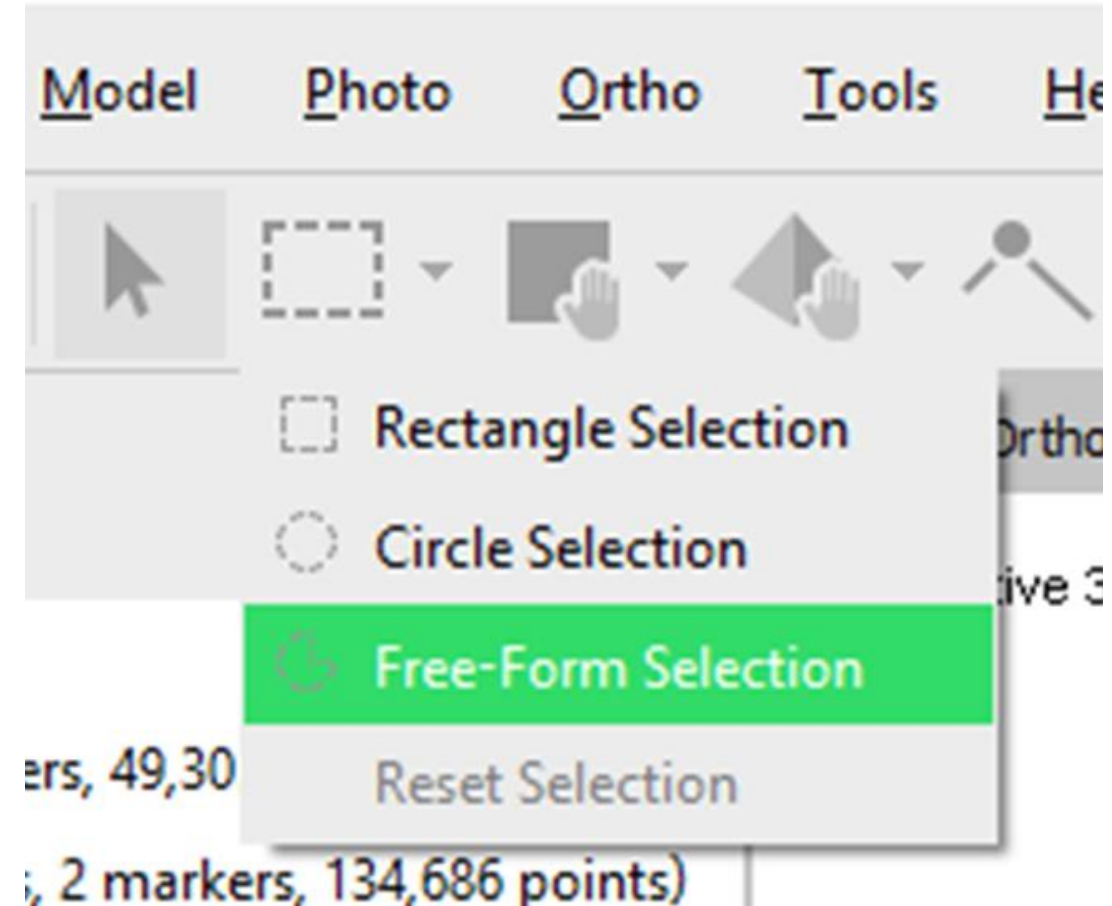
- Go to the Workflow menu, select the Build Dense Cloud option
- The 'Build Dense Cloud' dialogue will pop up, enter the following parameters:
 - **Quality:** Lowest/Low/Medium/High/Ultra High
 - Higher qualities will take longer to run
 - **Depth Filtering:** Aggressive/Moderate/Mild
 - Aggressive for subject with little delicate detail, Mild for subjects with fine detail
 - **Reuse Depth Maps:** Unselected
 - Select if you are re-running the dense cloud and wish to reuse the same depth maps
 - **Calculate Point Colours:** Selected
 - **Calculate Point Confidence:** Selected



4b. Dense Point Cloud (Optional): Clean/edit dense point cloud

Manual Point Selection

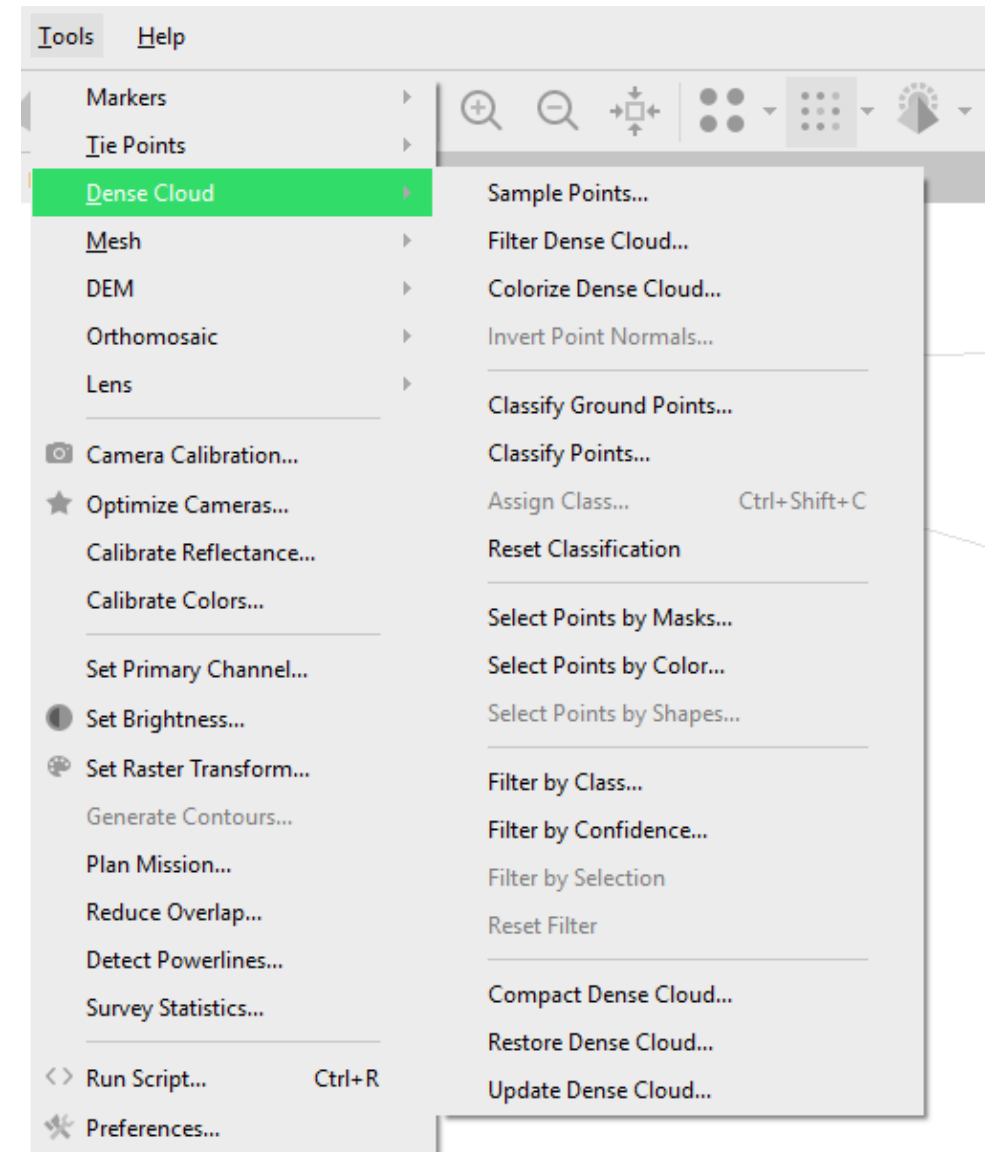
- Go to the selection tool in the icon bar, you will be able to choose between rectangle, circle, and free-form selection
- Select points manually by clicking and dragging the selection tool, selected points will be highlighted in pink
- Delete the selected points, but remember, the selection tool 'sees through' the points and will select all the points in line with the selection area



4b. Dense Point Cloud (Optional): Clean/edit dense point cloud

Automatic Selection

- Agisoft offers different methods of automatically selecting points
- Tools > Dense Cloud > Select Points by Colour... you can select points of a specific colour and choose the tolerance for this (i.e. only choose points of that specific colour or select all similar points)
- Tools > Dense Cloud > Select Points by Masks... Agisoft will select all points which exist outside of the chosen masks, more suitable for when you have a few very precise masks

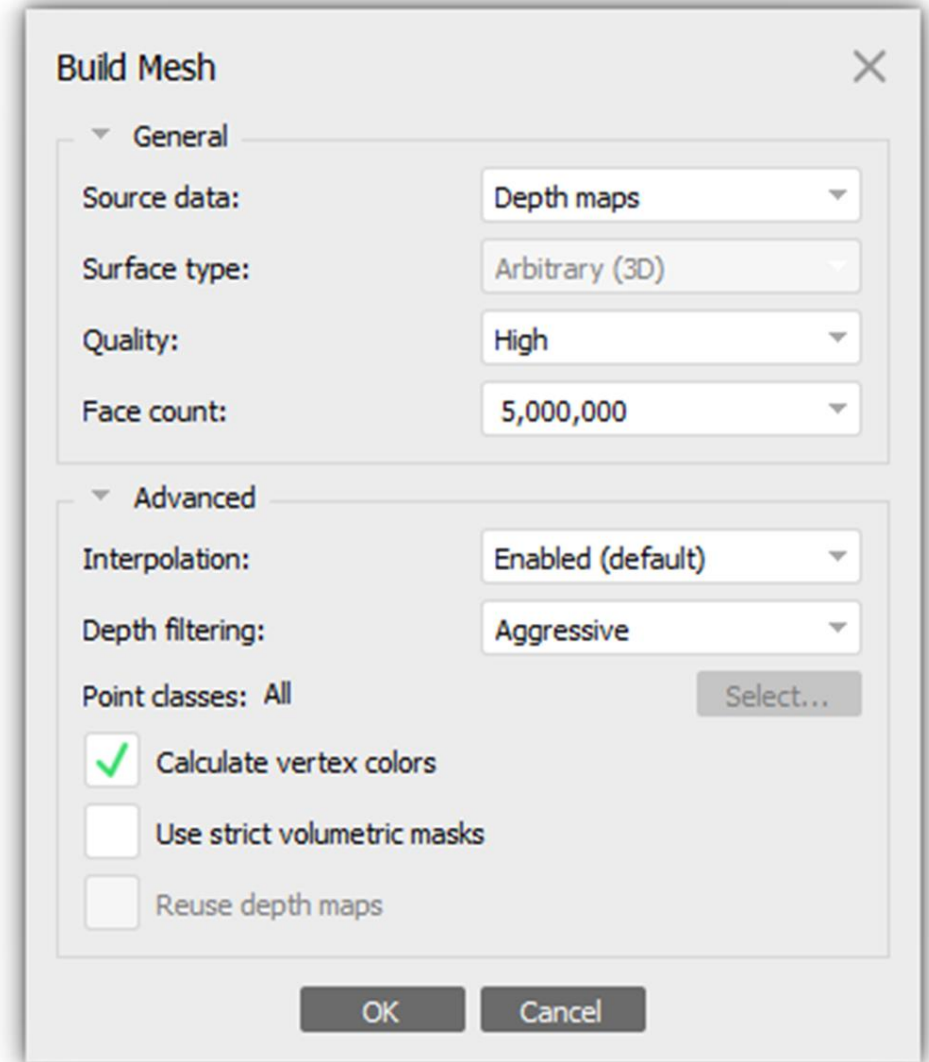


5a. Mesh: Running the process

Go to the Workflow menu, select the Build Mesh option

The 'Build Mesh' dialogue will pop up, enter the following parameters:

- **Source Data:** Depth Maps
 - If you built a dense cloud, choose dense cloud here
- **Surface Type:** Arbitrary (3D)
- **Quality:** High
- **Face Count:** High or Custom Number (e.g. 5mil)
- **Interpolation:** Enabled (default)
- **Depth Filtering:** Aggressive/Moderate/Mild
- **Calculate Vertex Colours:** Selected
- **Use Strict Volumetric Masks:** Unselected



Build Mesh

General

Source data: Depth maps

Surface type: Arbitrary (3D)

Quality: High

Face count: 5,000,000

Advanced

Interpolation: Enabled (default)

Depth filtering: Aggressive

Point classes: All Select...

☒ Calculate vertex colors

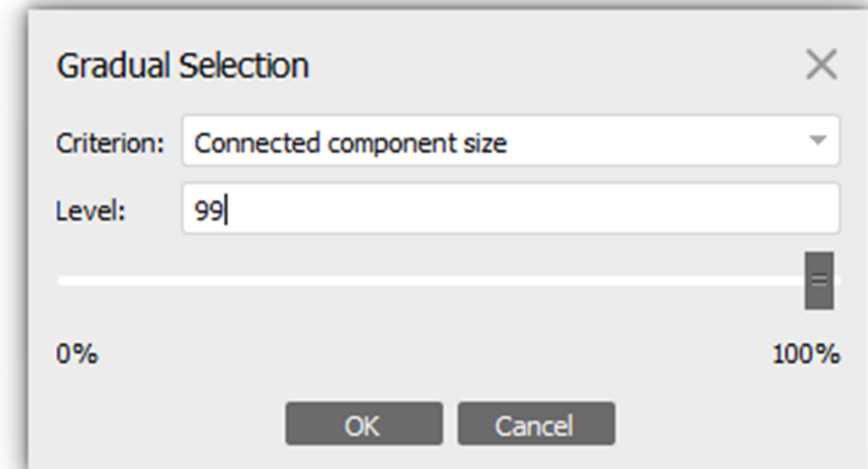
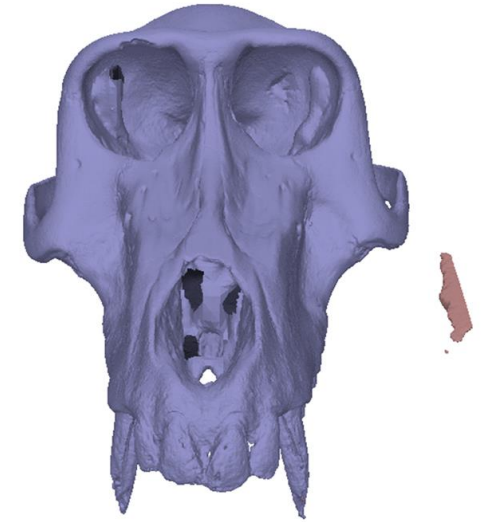
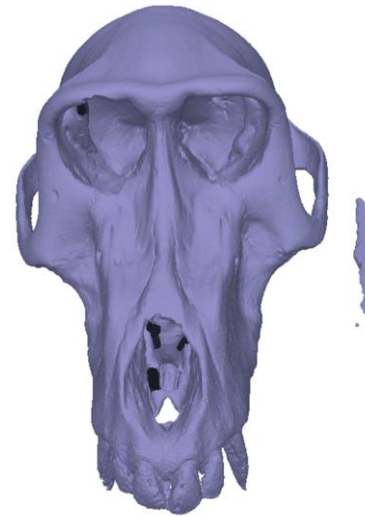
☐ Use strict volumetric masks

☐ Reuse depth maps

OK Cancel

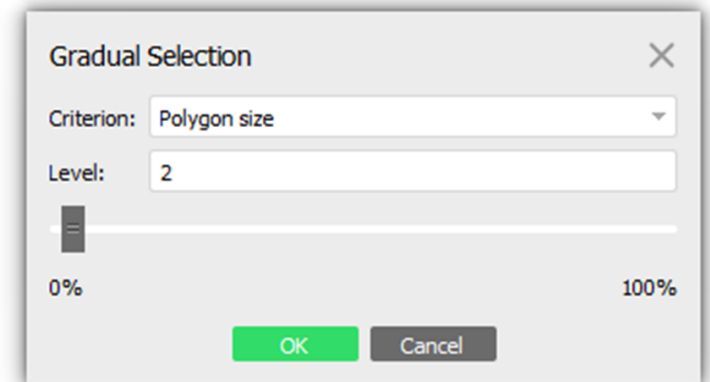
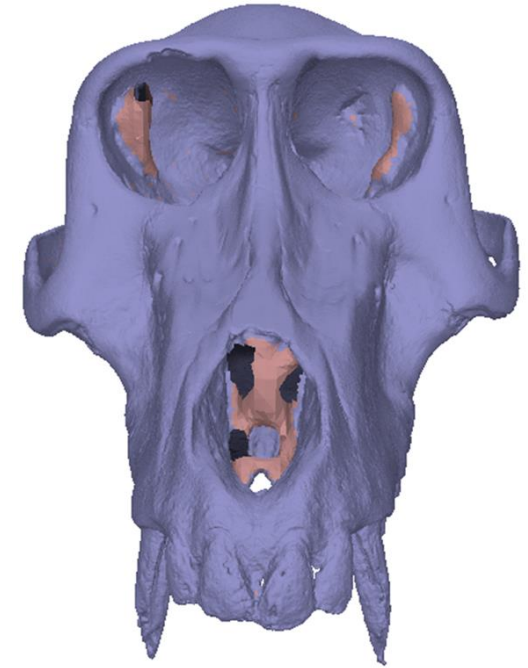
5b. Mesh: Cleaning

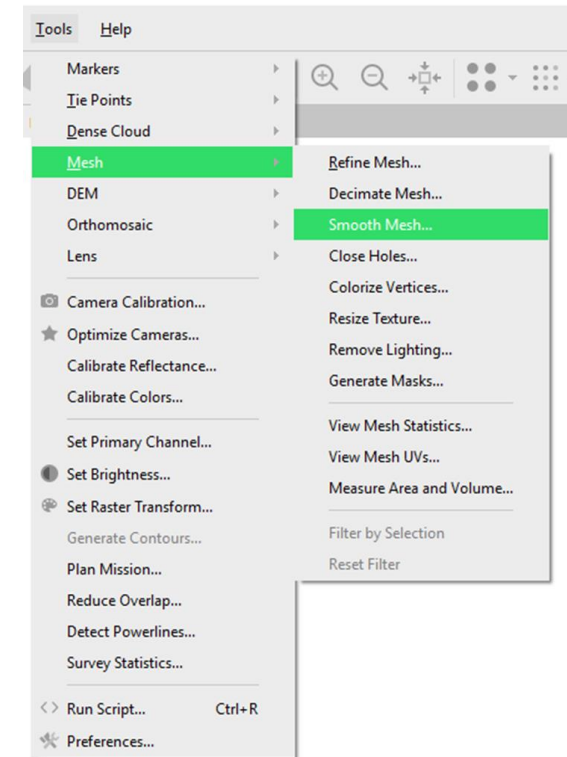
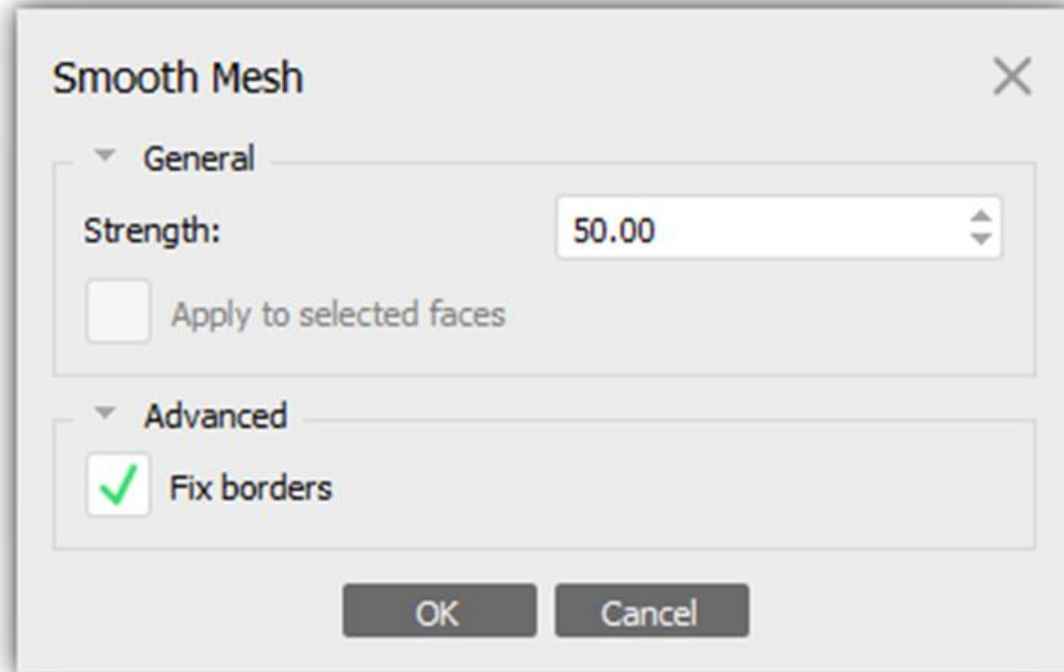
- Sometimes parts of the background or scale bar will reconstruct, you will need to delete these 'floaters'
- You can either delete parts of the mesh using the manual selection tool (see 4b. Dense Cloud Clean Up for guidance)
- Or you can use the Gradual Selection tool
 - Model > Gradual Selection
- The gradual selection tool will offer two options, 'connected component size' and 'polygon size'
- The 'connected component size' will select floating fragments of mesh on a sliding scale based on size. If you choose a level of 99, everything except the biggest mesh will be selected. If you are happy with the selection, select ok and delete the selected mesh



Mesh: Cleaning

- Sometimes, meshes will have artefacts attached to the model, as a result, they can be difficult to delete
- The connected component size tool cannot be used as it only selects floaters
- The gradual selection polygon size tool can help in this instance
 - Model > Gradual Selection > Polygon Size
- Polygon size selects polygons on a sliding scale, beginning with the largest polygons and increasing to the smallest
- This can be useful as artefacts tend to be made up of very large polygons





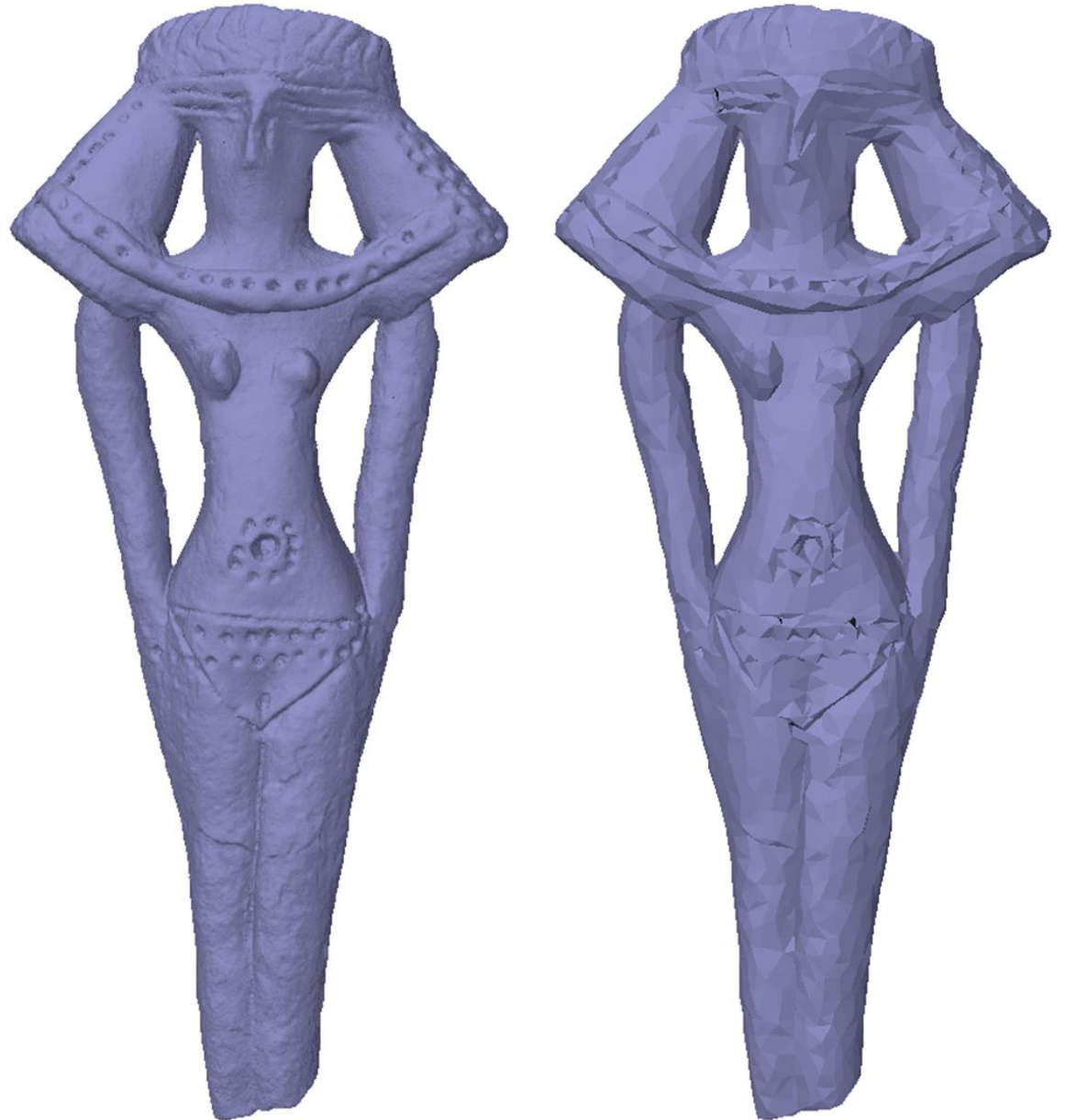
5b. Mesh: Cleaning (Smoothing)

- Go to Tools > Mesh > Smooth Mesh...
- Note that you can smooth specific areas of a mesh. Select your desired area with the selection tool in the icon bar. In the smooth mesh dialogue box, select the 'Apply to selected faces' option
- You can choose the strength of your smoothing , start low (e.g. 5) and work up. Remember to keep a duplicate, unedited chunk in case you over-smooth



5c. Mesh: Decimation

- Go to the Tools menu, go down to the Mesh option and select 'Decimate Mesh...'
 - Tools > Mesh > Decimate Mesh...
- The decimate mesh dialogue box will pop up, input your desired mesh size
 - We prefer 64k for uploading online
- You will be asked if you wish to replace your default model, select no if you want to keep your original mesh





6a. Texture: Refine Images

Refining Images

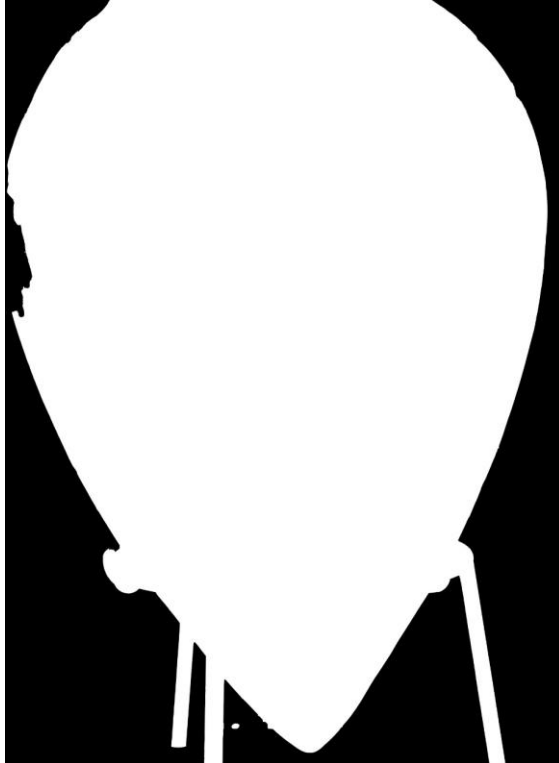
- If you haven't done this already, run the Image Quality Assessment (see slide 'Importing Photos: Refining Selection' for guidance on how to do this). Remove any images which have motion blur/camera shake
- If you do not do this, your texture will be less sharp and will likely have blurred patches
- Note: if lighting conditions were inconsistent throughout the photography, you may want to run Colour Calibration (see page 38 of the Agisoft manual)

Masks

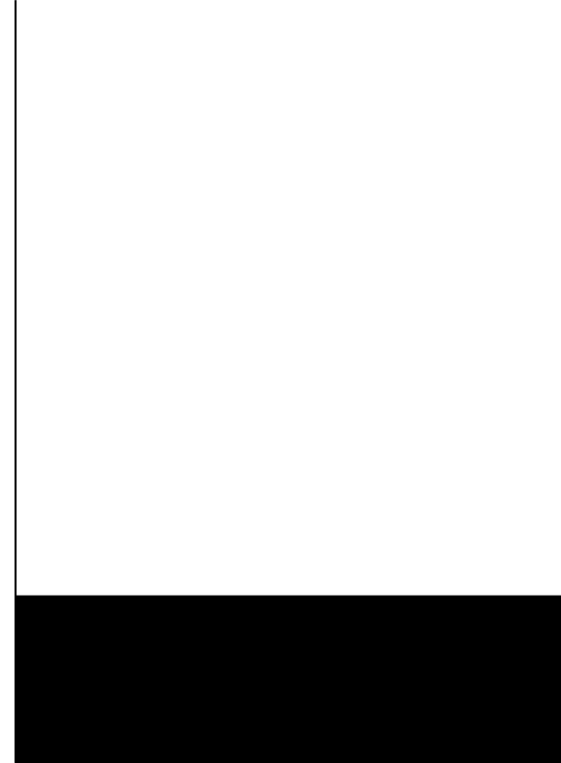
- You can edit masks by hand to exclude all out of focus areas
- Or you can use our advanced depth mask method, consult the online guide (forthcoming) for more information



Original Image



Photoshop Subject Select Mask



Paint Created Mask



Union of Masks

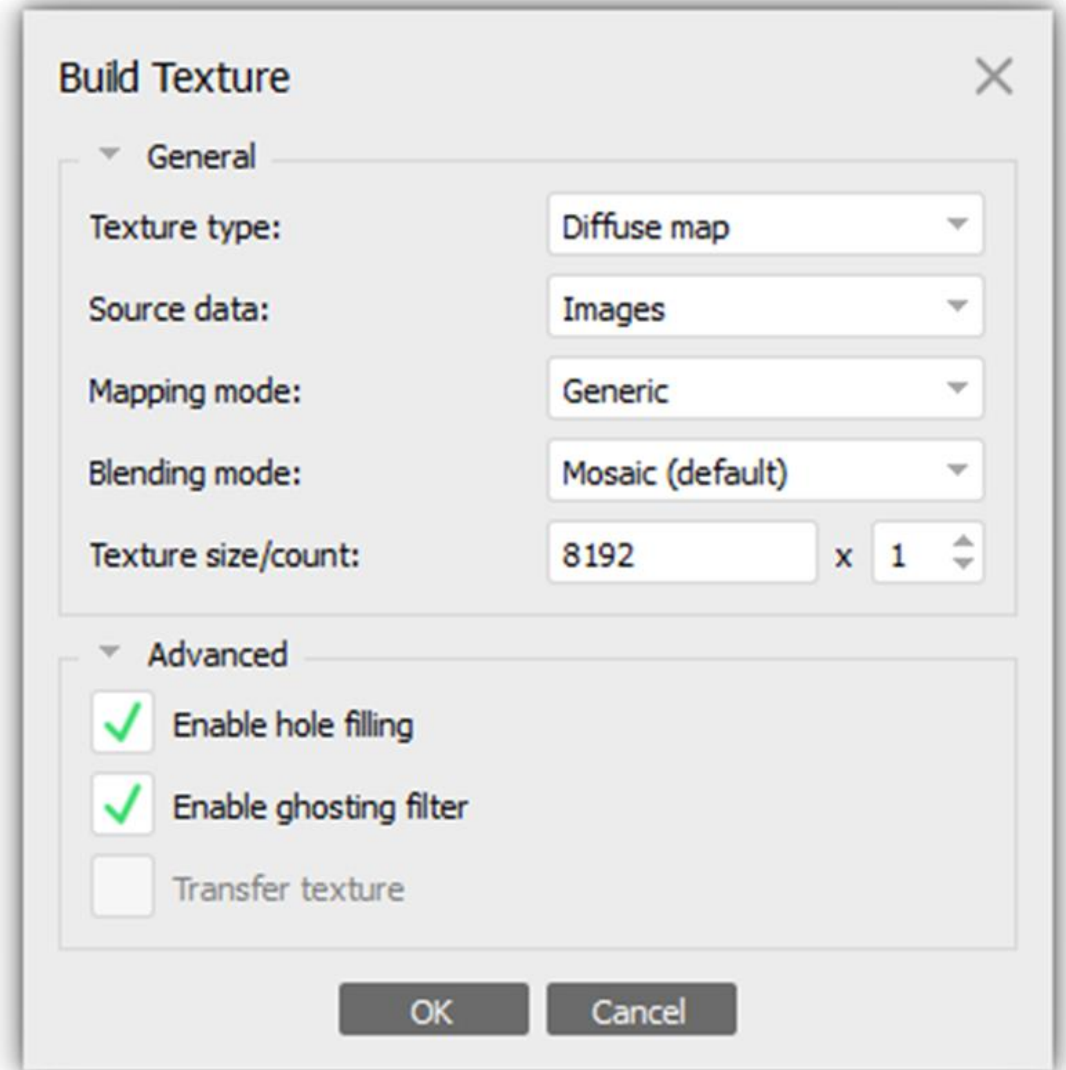
6a. Texture: Refine Images

Ghosting: Creating and Combining Masks

- To avoid colour artefacts on your texture from background or support materials (aka ghosting), create a quick mask in paint (see image 3) where the black portion of the image will be masked out
- Combine this mask by selecting the photographs where the support is visible, and import the mask using the 'Import from Background' method and the 'Union' operation

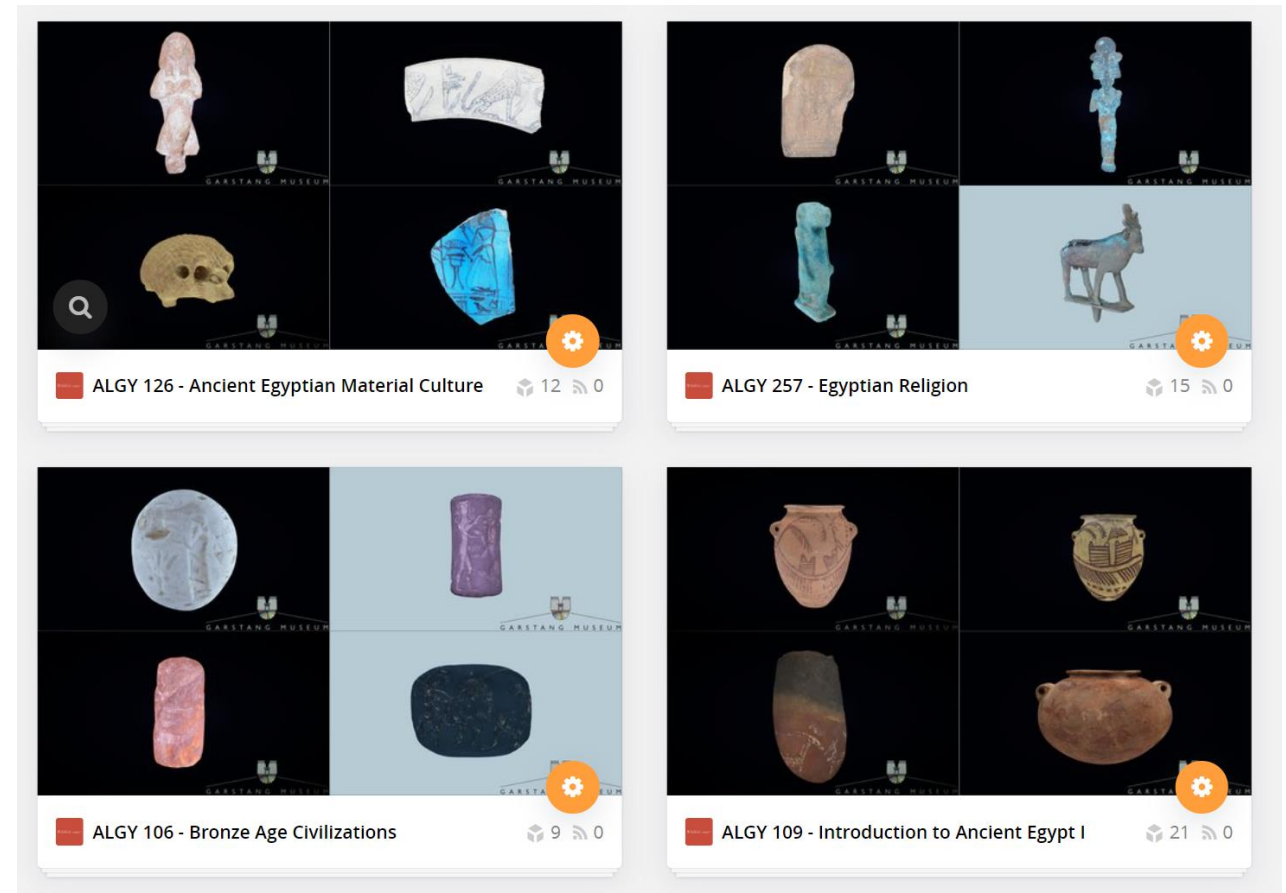
6b. Texture: Running the Process

- **Texture Type:** Diffuse Map
- **Source Data:** Images
- **Mapping Mode:** Generic
- **Blending Mode:** Mosaic or Average
- **Texture Size/Count:** 8192 x 1
- **Hole Filling Enabled:** Selected
- **Ghosting Filter:** Unselected
 - Unless there are thin structures or moving objects in your images, then select this option



7. Export

- File > Export Model
 - In the dialogue box, name your file and choose the file type for export. We export as .obj
 - Export as an .obj will produce three files, an .obj file, an .mtl file, and a .jpg file
- Note that Metashape allows for direct uploading of models to Sketchfab. To do this, go to the File menu and select Upload Data...



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- University of Liverpool Alumni and Friends Fund
 - Provided extensive start-up funding for the Photogrammetry Team in 2019–2020. They also very kindly continued to fund additional equipment to facilitate further expansions of our activities in 2020–2021.



Art Fund_

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TRUST _____