

# SunoikisisDC Session 9

## 3D Modelling in Cultural Heritage

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Gabriel Bodard (ICS)

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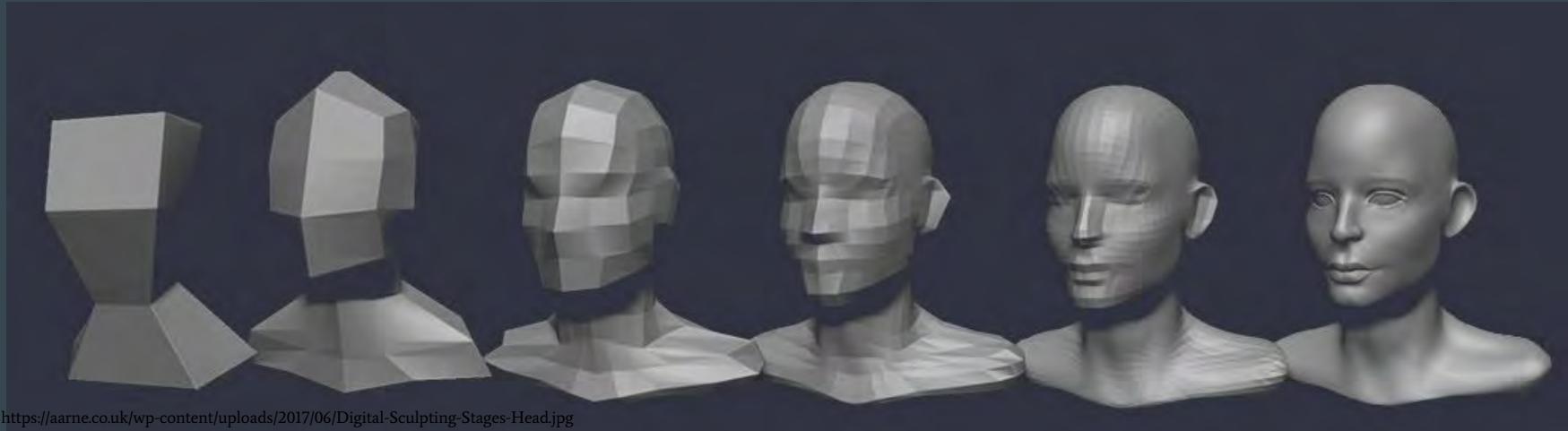
Chiara Piccoli (University of Amsterdam)

Vasiliki Lagari (Leiden University)

# What is 3D Modelling?

The creation of a 3D digital representation of an object or landscape as if may or may not exist in materiality.

- Computer-aided design (CAD)
- Digital Sculpting
- Procedural modelling
- Simulations and Virtual Worlds
  - Sims, Second Life, Minecraft
- Real Time Engines
  - Unreal, Unity3D



# 3D modelling for Cultural Heritage

Used for visualizing objects that do not exist (anymore), have changed over time, or are inaccessible.

Applications:

- Visualizing light and shadow
- Investigate lines of sight
- Simulate structural strength
- Communicate research findings (public outreach)





Sunoikisis DC

## Case study: Visualizing 17<sup>th</sup> century Amsterdam interiors

Chiara Piccoli

18 March 2021



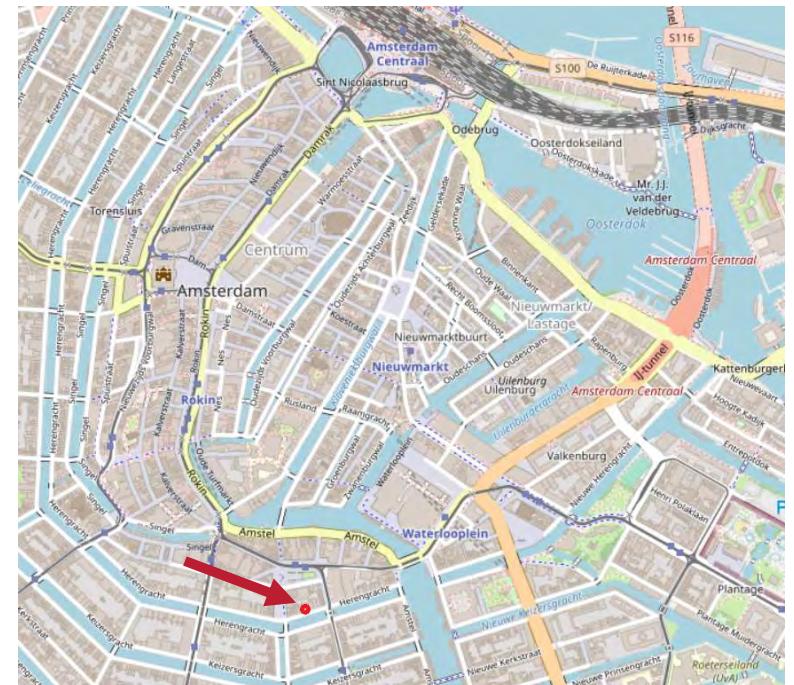
<https://virtualinteriorsproject.wordpress.com/>

## At home at Herengracht 573, Amsterdam

Research question: Investigating the domestic consumption of cultural industries in the house of **Pieter de Graeff** (1638-1707) and **Jacoba Bicker** (1640-95), at **Herengracht 573**



Caspar Netscher. Portraits of Pieter de Graeff and Jacoba Bicker. 1663



## Themes

- 1 Schematic and photorealistic 3D reconstructions: Different visualization modes for different purposes
- 2 Modelling hundreds of books: challenges and workarounds
- 3 The use of 3D reconstructions as research tools
- 4 Documenting the reconstruction process and sources and making them accessible

## Free and Open Source Software used:



Hand-made modelling: **Blender**  
<https://www.blender.org/download/>

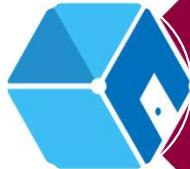


Image-based modelling: **Meshroom**  
<https://alicevision.org/#meshroom>



3D processing and editing: **MeshLab**  
<https://www.meshlab.net/>

# At home at Herengracht 573



## Almanacs (1664-1706; 1700 missing)

House (plan,  
fixed elements,  
decorations...)

## Artisans, artists, acquaintances

## Household objects, their locations and values

## Probate inventory (1707)

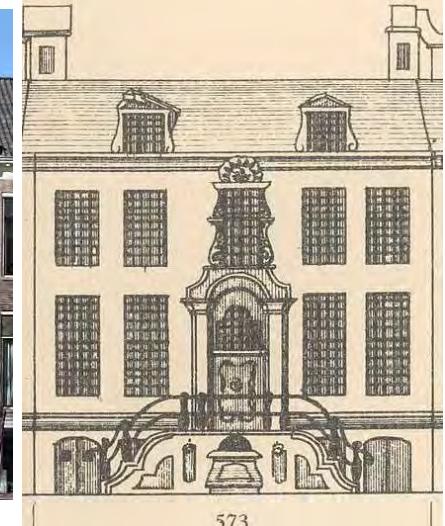
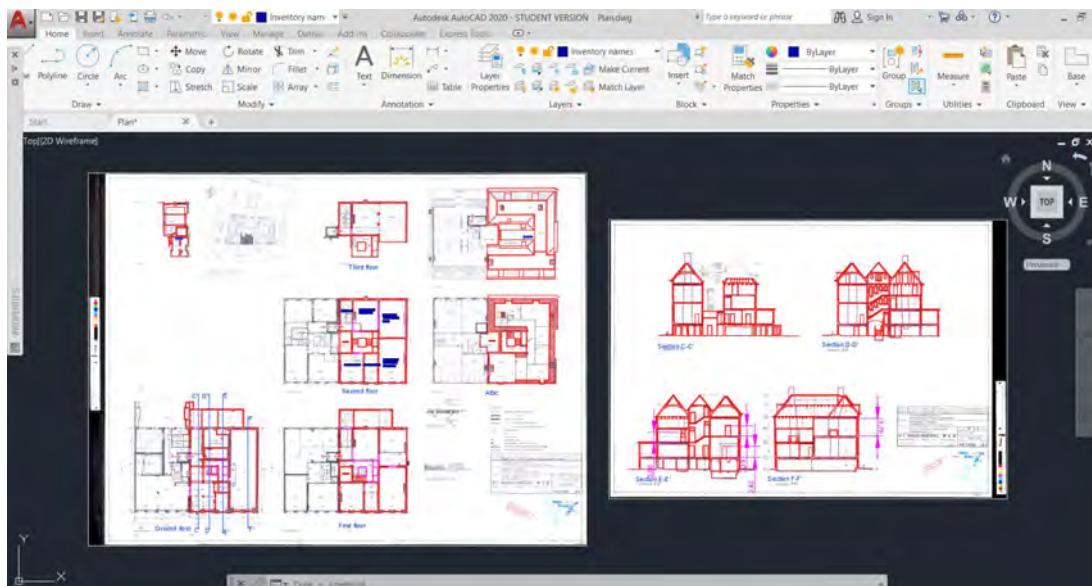
3 Maart 1702  
verstreken

69

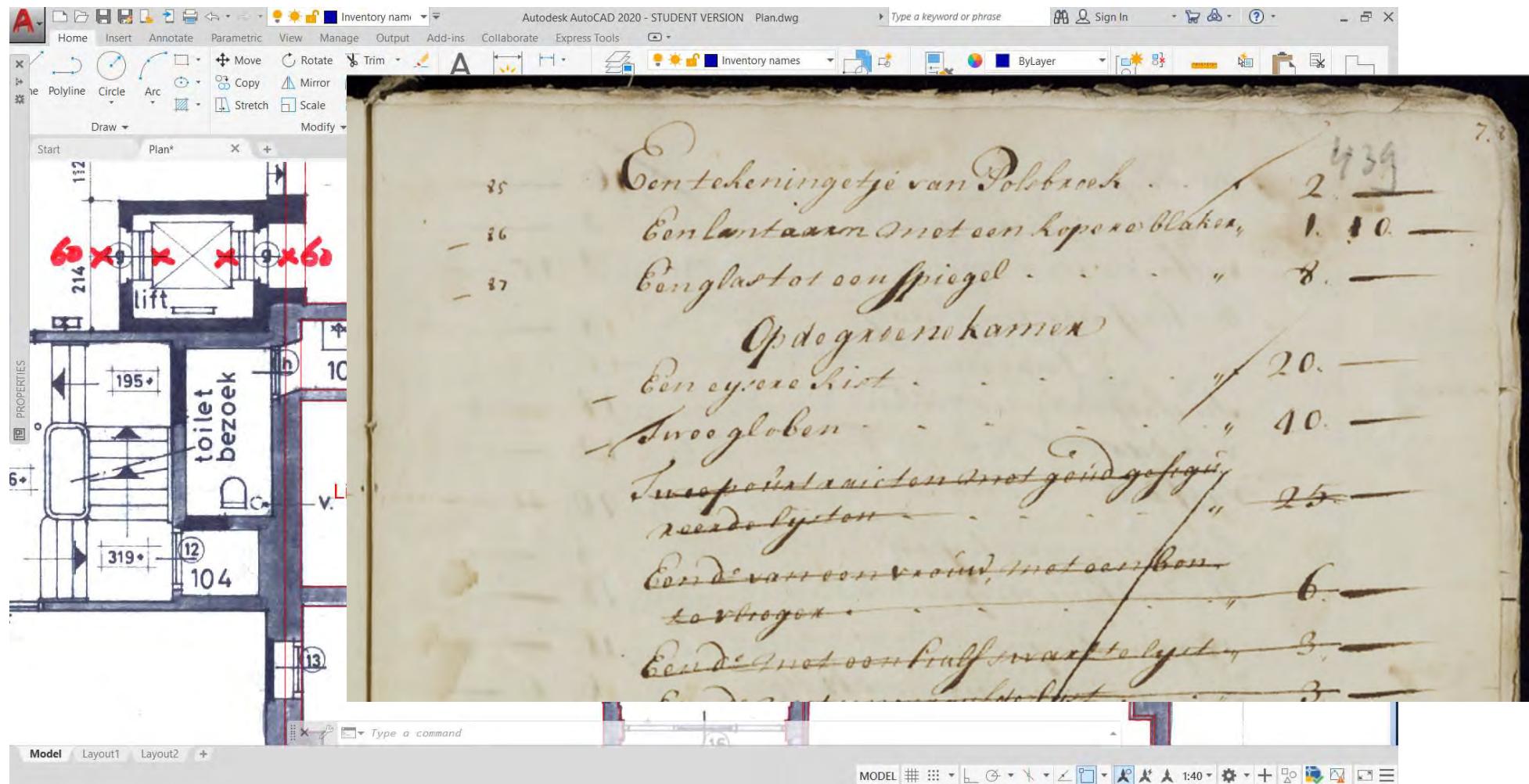
Vinrentaris van alle de  
gronden, mitselde, enigerhande inde  
mitbedde, enghemint ghedaen, d'laet  
principeken vande hofd'gheveld, ten anno  
1692 v... Algemeen den XII. Oct. 1692  
Pieter de Graeff, ... D'Uitgheven  
Den Hove van Lijp Colleghie  
van Oudehouten en IJpervliet  
mitgedeeld v... Vespasius sids  
Bewijsstukken vandt.

Indias Compagnie v... v...  
Stad gronden tijc in Den H...  
M. Geestling op d' D...  
grond hulst en de Regt'gheveen  
grond vnde v... hofd'gheveen grond  
van Oudehout van Oudehout Agneta  
de Graeff, Breygheveen en  
Breygheveen vnde M. H... Van Breygheveen  
de Breygheveen. Oud Schippen waren  
der H... Land by Den H... Agneta  
de Graeff der v... v... D. Aalst  
Breygheveen d'laet'gheveen,

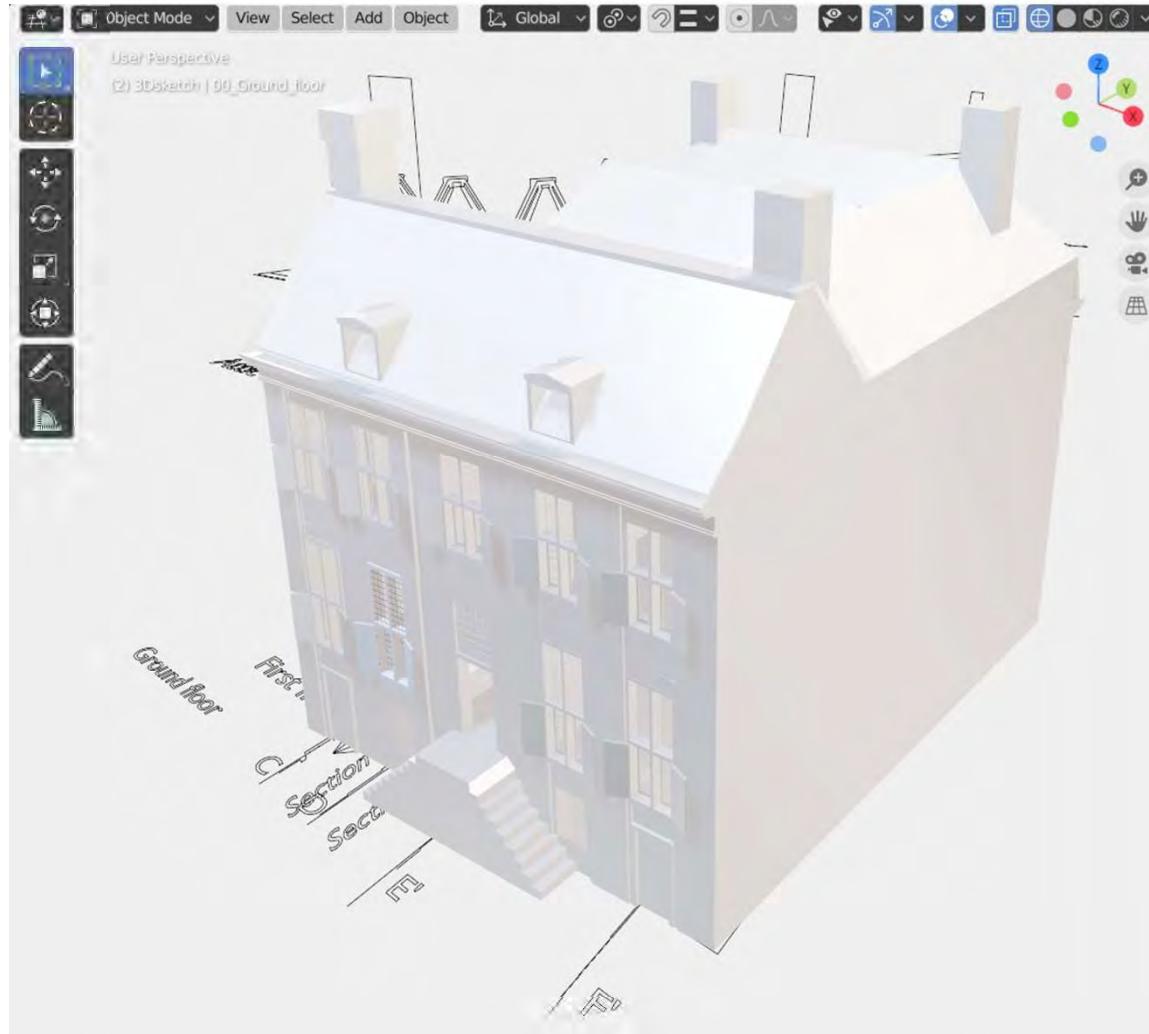
## At home at Herengracht 573



573  
Drawing by Caspar Philips, ca. 1770

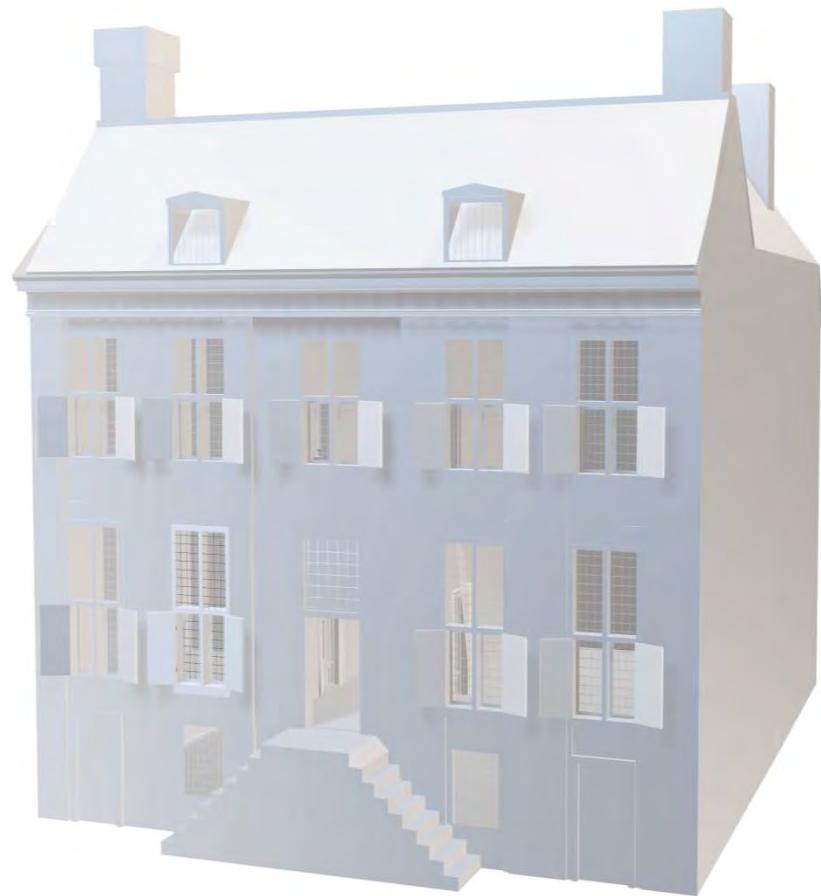


Digitized plans  
(dxf) imported into  
Blender served as  
the starting point  
for the 3D  
reconstruction



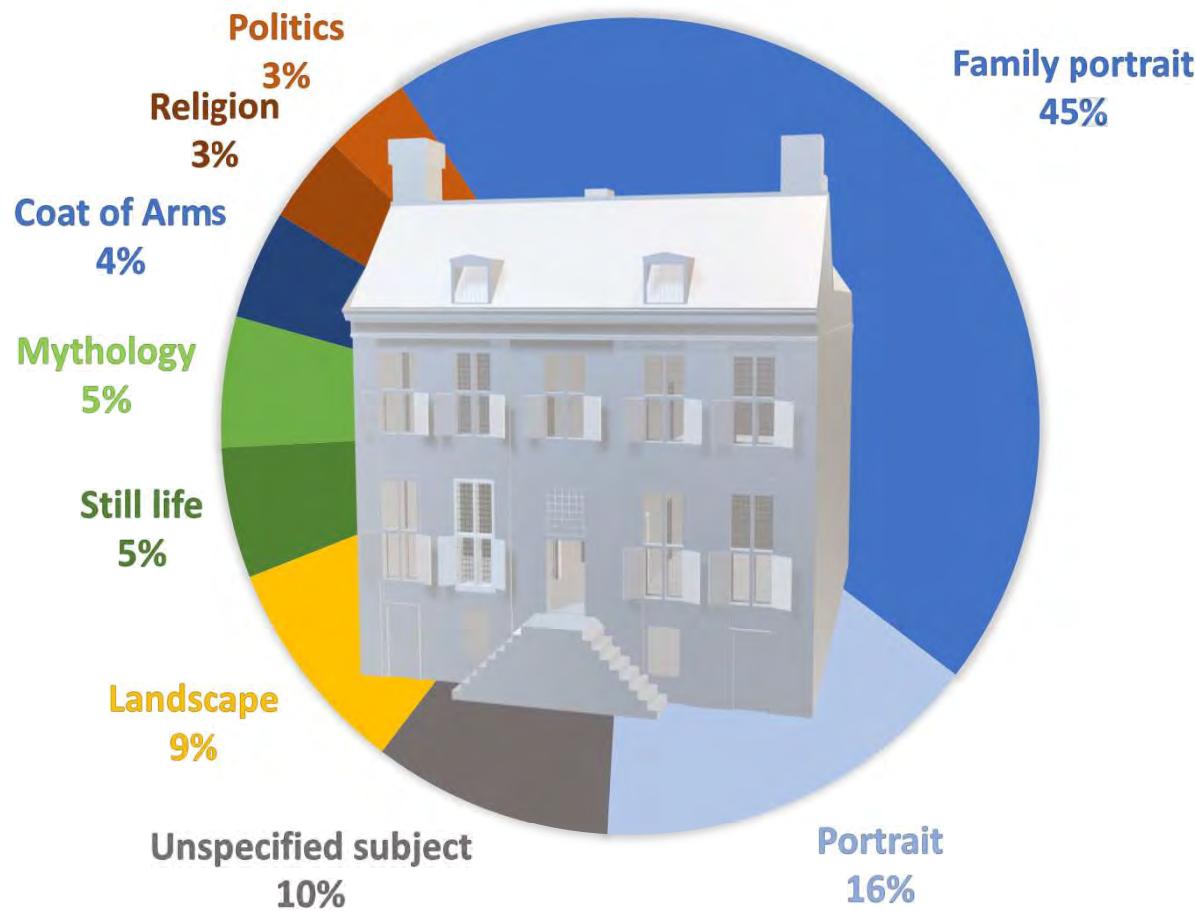
# Reconstructing the spatial arrangement of rooms and household objects

417	
Dieren, Openbaar, Notarid tot Dantum, Dant, byden Sd: Rous van Holland grondmunt, in houwels vuid i man, ghevoerd ghetijgen	
Cordelijch, ten Coorn Hout, t' acht D.	
Op de Soldet	
- en hevanten die niet dry staengen 2	
- Drie du twintig hellefotchen, een groot als helen. 14	
- Day schalen 4	
- en geudde en mangt uichels ralen in des seft haaff. 6	
- agtde, parapluiken, een groot als helen. 4. 10	
- In kleynen hellestaaffit mit 2 litringen. 1.	
- Soe mangt bordi mit dry stofchen. 6.	
- en hiel te conuinen hout. 1. 3	
- Drie toardschalen 6.	
- en manid mit twintig distilleer glasen. 1.	
- en esterl ledetcent mit hexoed schroeden. 8.	
418	
- tweo oids tsaengen 5	
- En knobbe, veide oudermat, mit ding nide miedeck. 1. 10	
- agt oids hoffbos 8.	
- tweo marmersteens e mortibijtjes mit drie vingers. 5.	
- Day kleynen stort passijnen 1. 10	
- en kinder strok in twijfle midden ante groten 1.	
- Van brandzijl 3.	
- en oids borstic in leghda 1. 10	
- en oids hewentrot 1. 10	
- Tit wette appelenmeide 1. 10	
- Prog enig oids miedeck in by rotting midden 2.	
- Day oids lantamore 10.	
- Drie boven hellestaaffit Proy Roudapionair van Holland ad West, antwoerd pofallen. 20.	
- En yplinden t' offe voet 1. 10	



## Spatial distribution of paintings (work in progress)

Tot. 111 paintings  
(based on De Graeff's probate inventory)

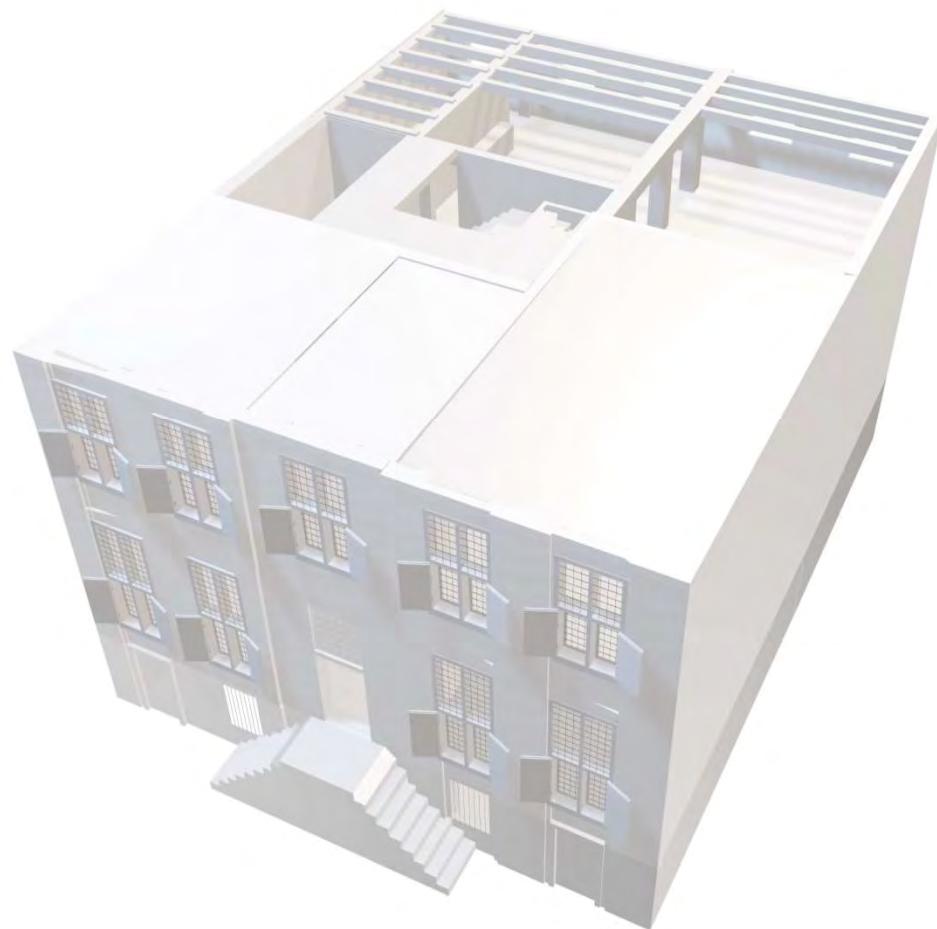


## Spatial distribution of paintings



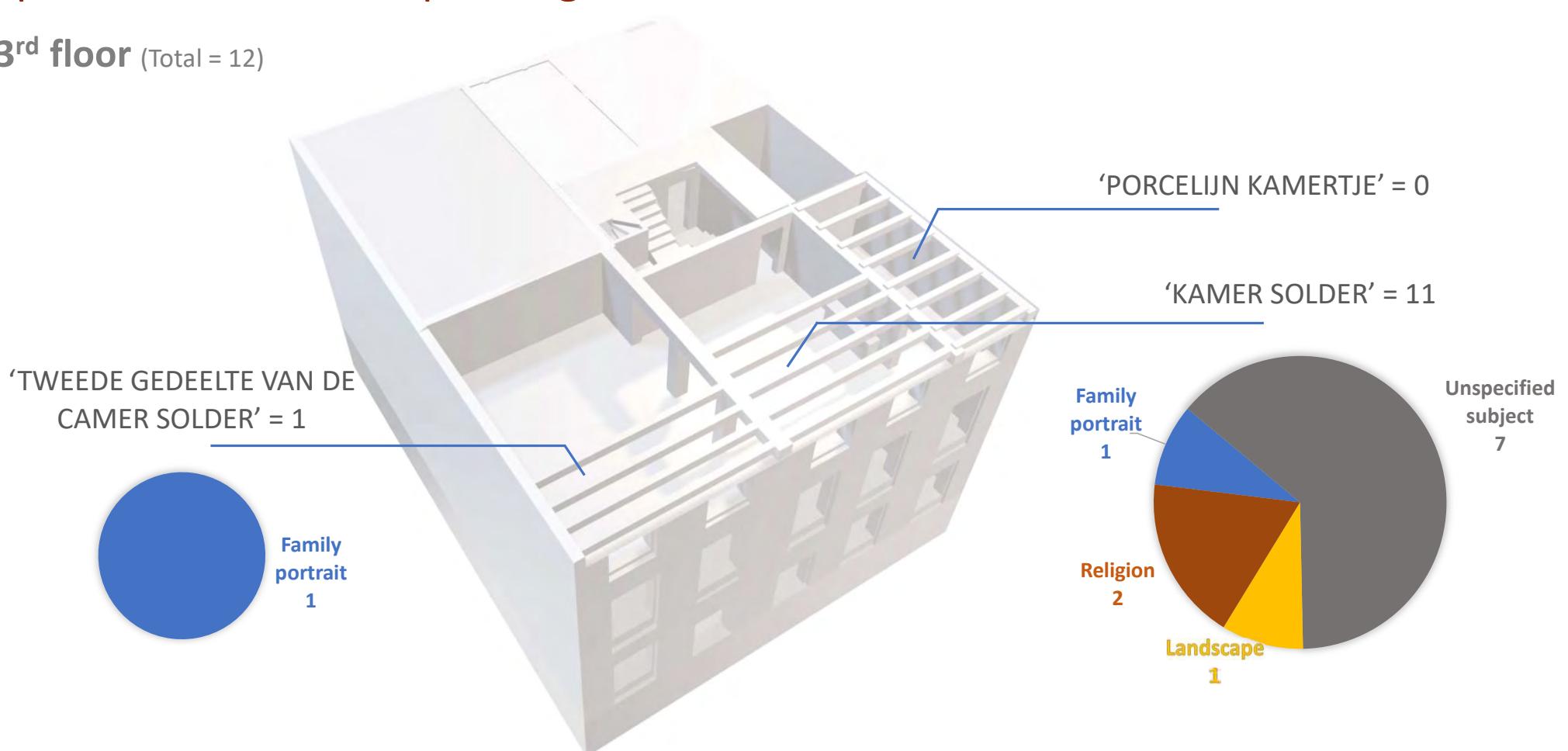
## Spatial distribution of paintings

3<sup>rd</sup> floor



## Spatial distribution of paintings

3<sup>rd</sup> floor (Total = 12)



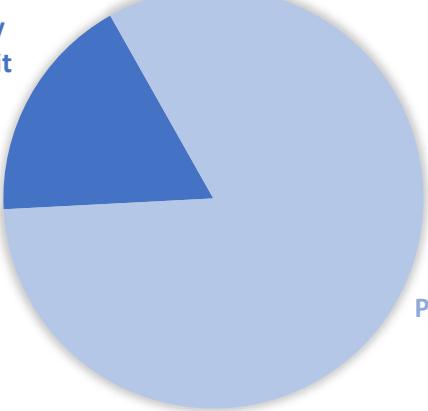
## Spatial distribution of paintings

**2<sup>nd</sup> floor** (Total = 88)

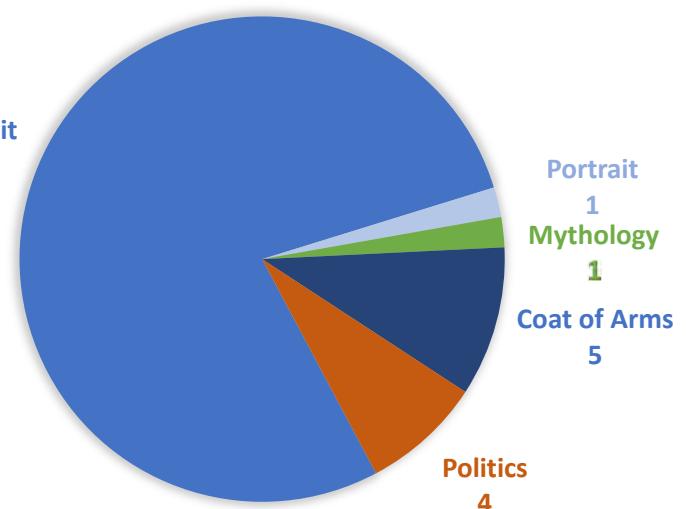
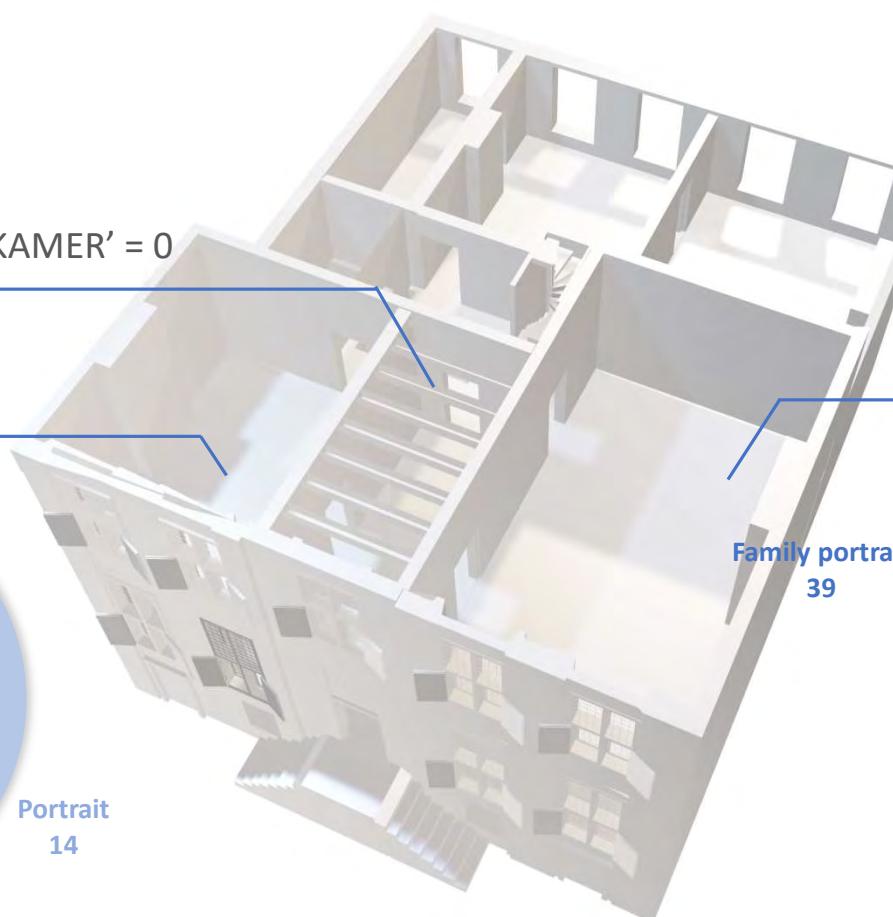


'GROENE KAMER' = 17

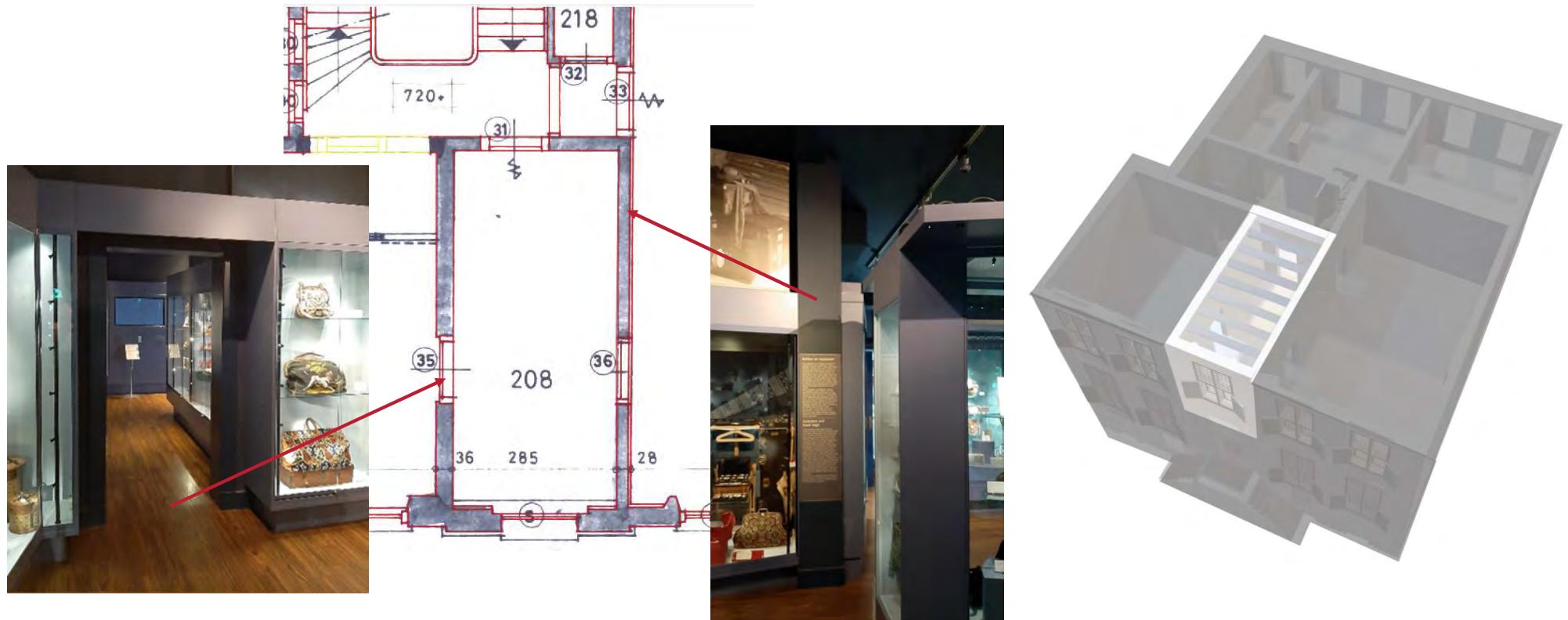
Family portrait  
3



'BOEKEN KAMER' = 0



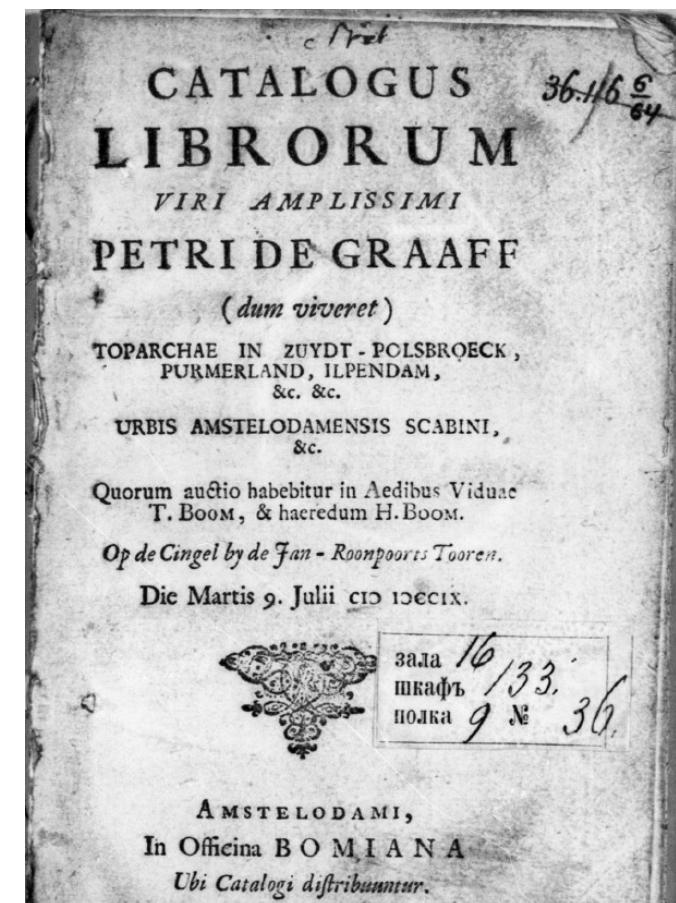
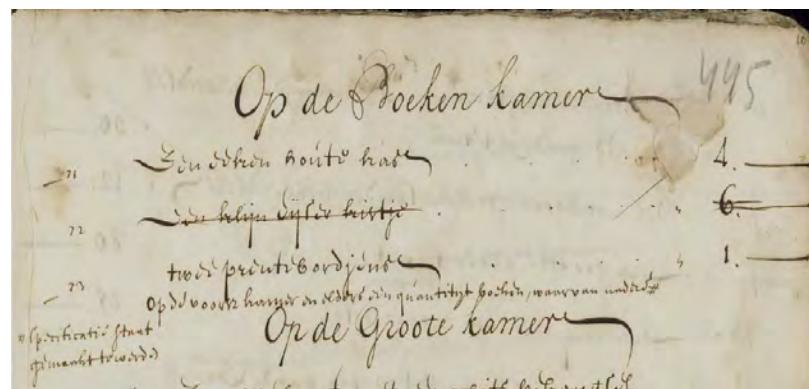
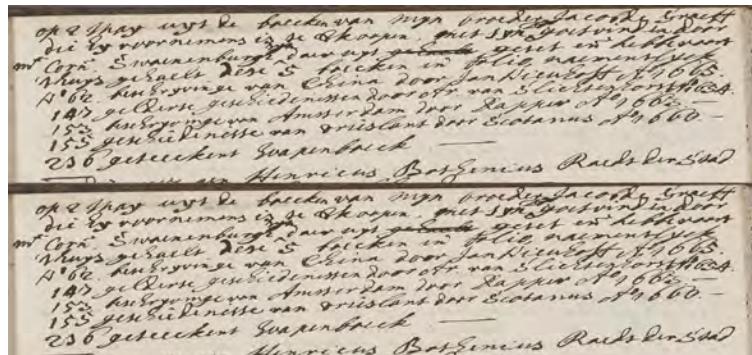
## De Graeff's private library ('Boeken kamer')



## De Graeff's private library

### Archival and historical sources:

- De Graeff's almanacs
- Probate inventory
- Testament
- Book auction catalogue



## De Graeff's private library



## De Graeff's private library

### Strategies for modelling books

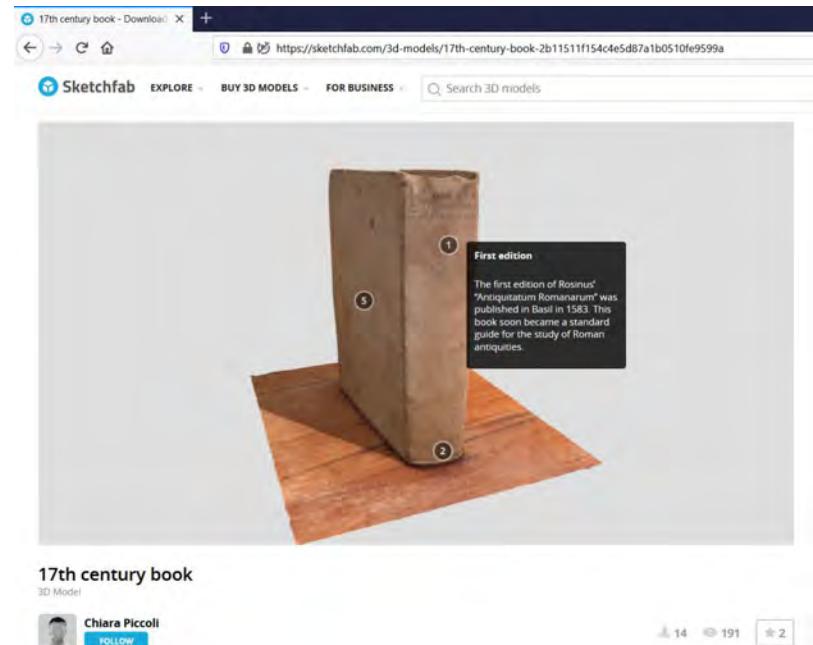
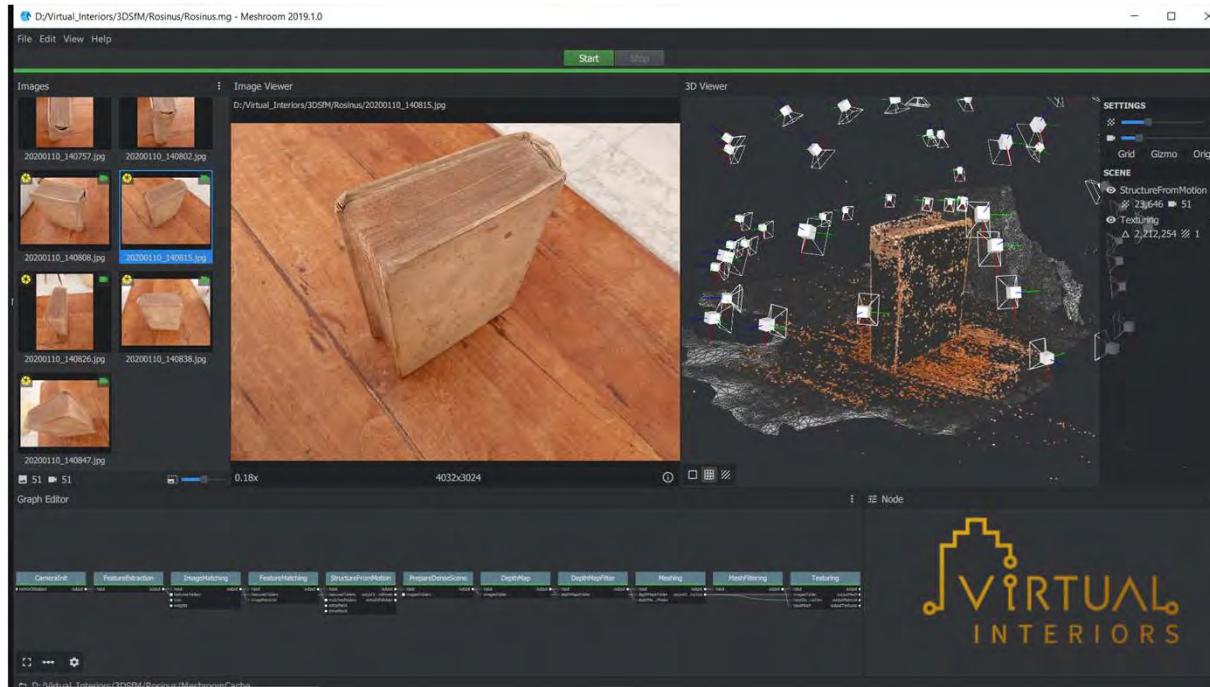


Image-based modelling (high res) for a few books



Manual modelling in Blender (low-poly) for the hundreds of books on the shelves

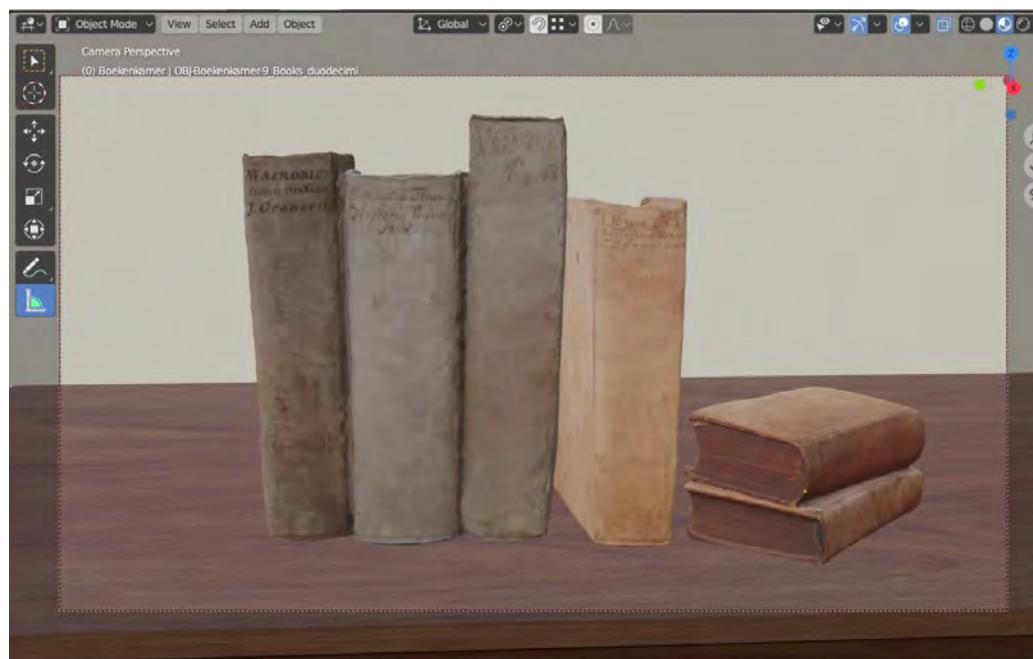
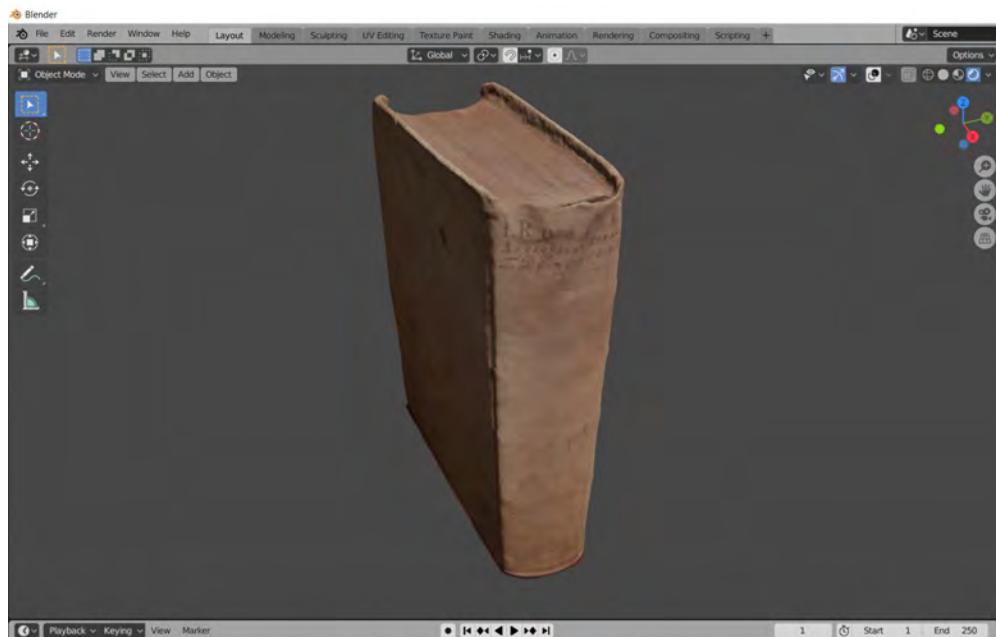
## Image-based modelling (high res) for a few books



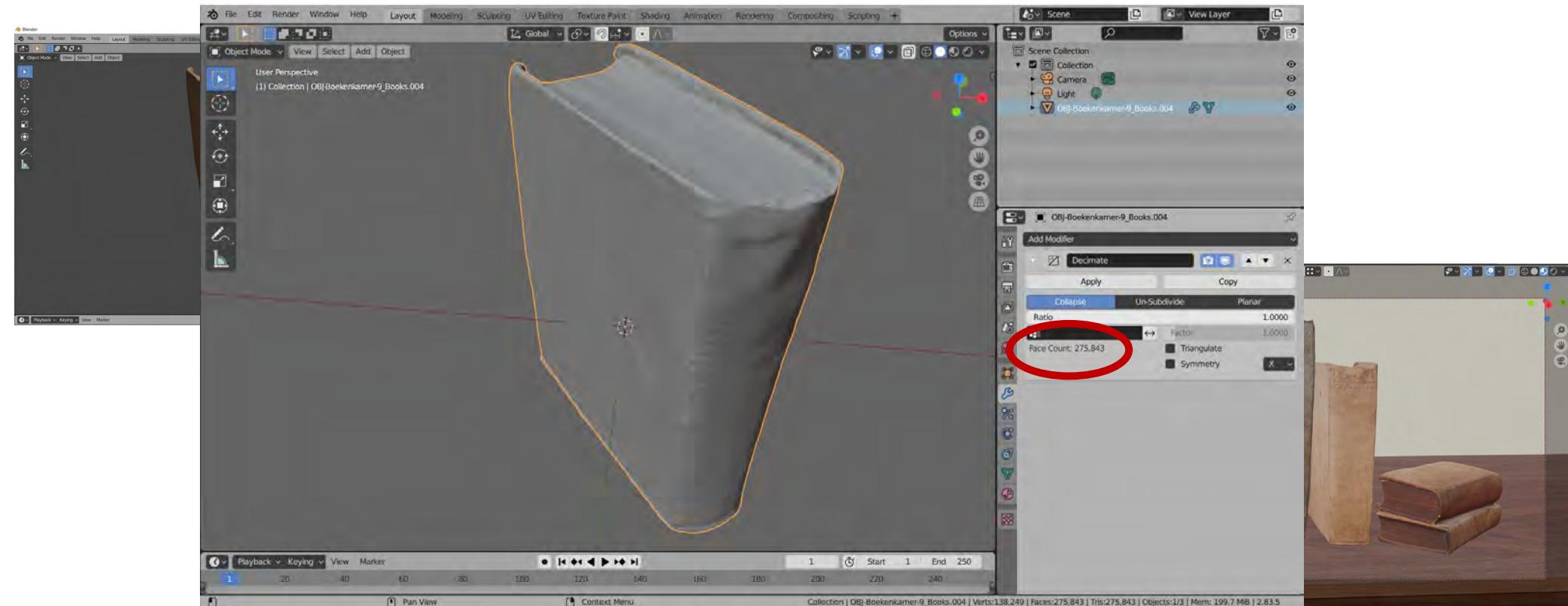
Free download on Sketchfab



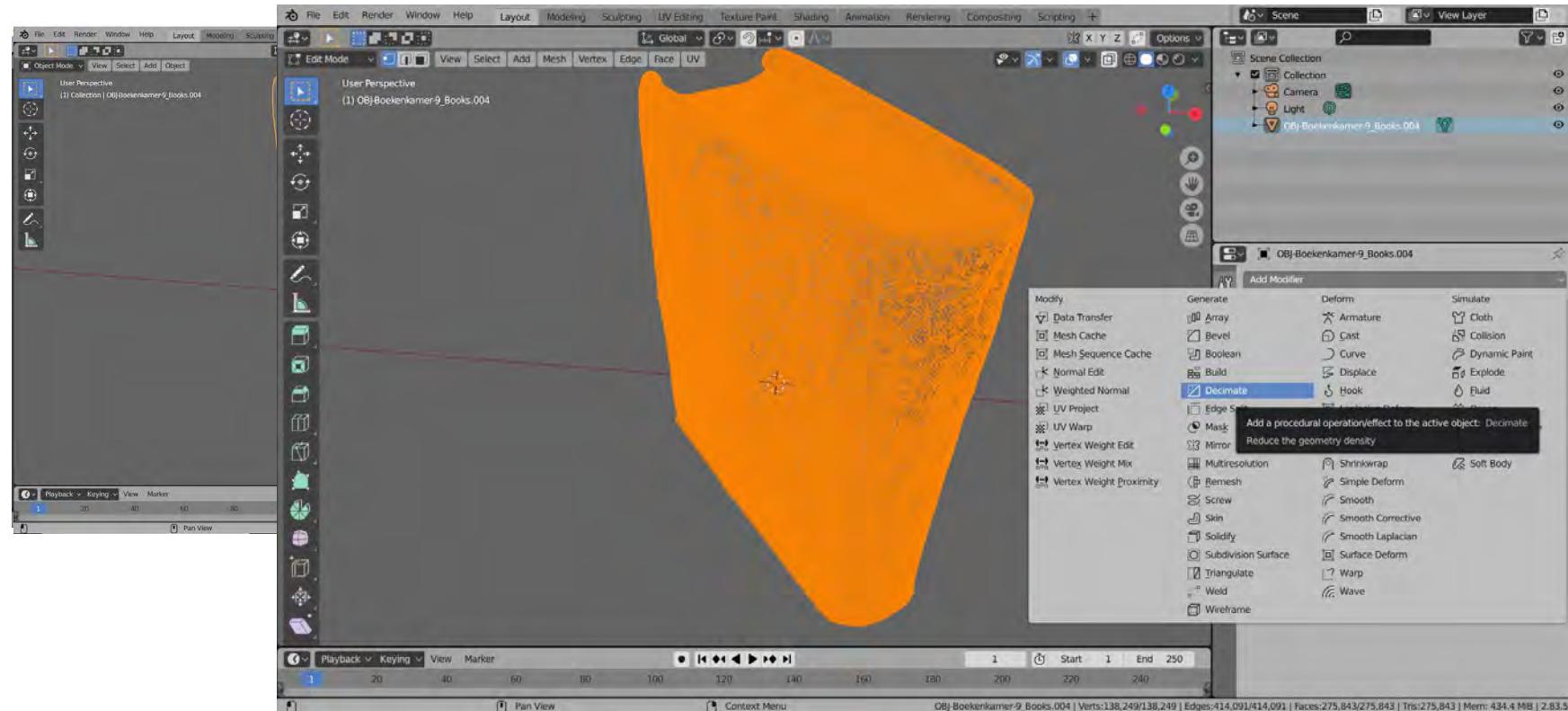
## Image-based modelling (high res) for a few books



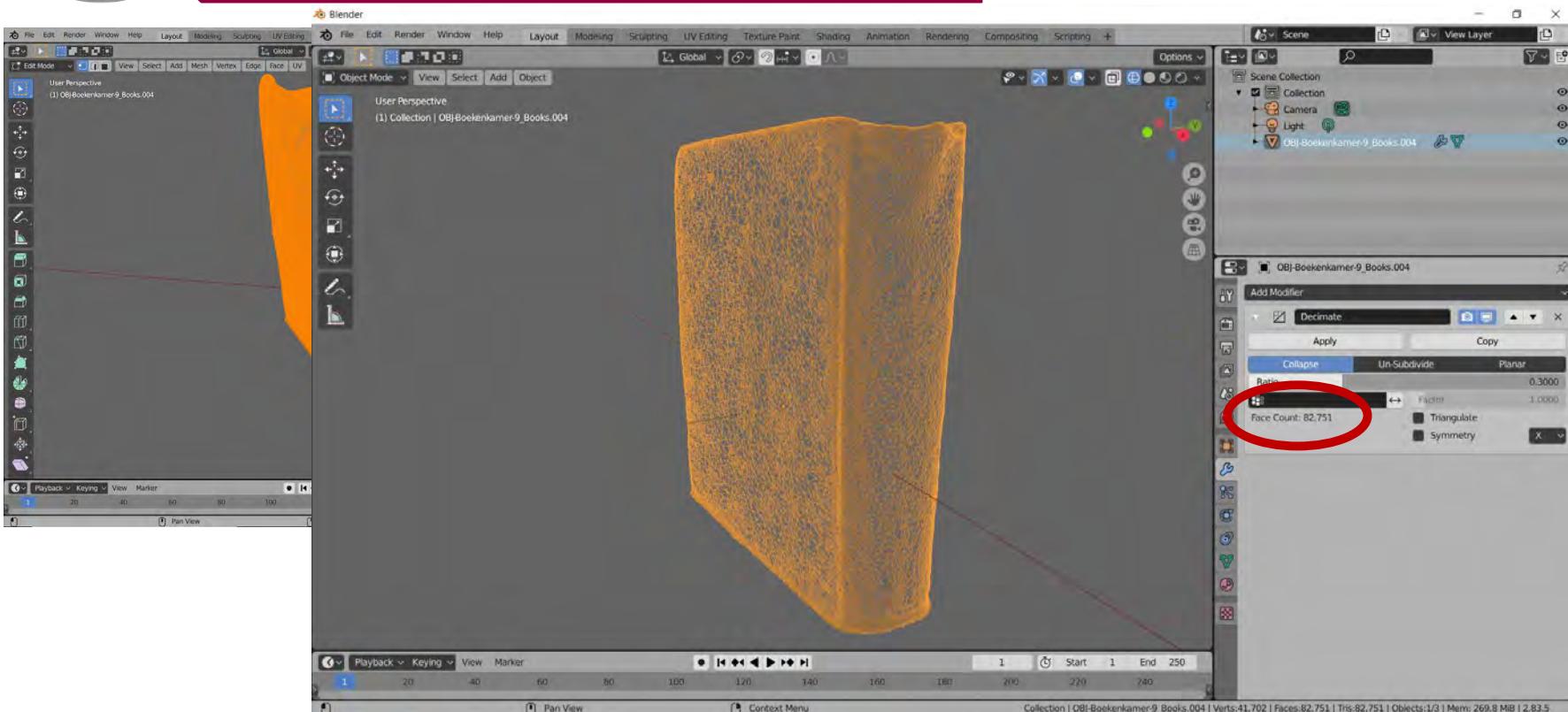
## Image-based modelling (high res) for a few books



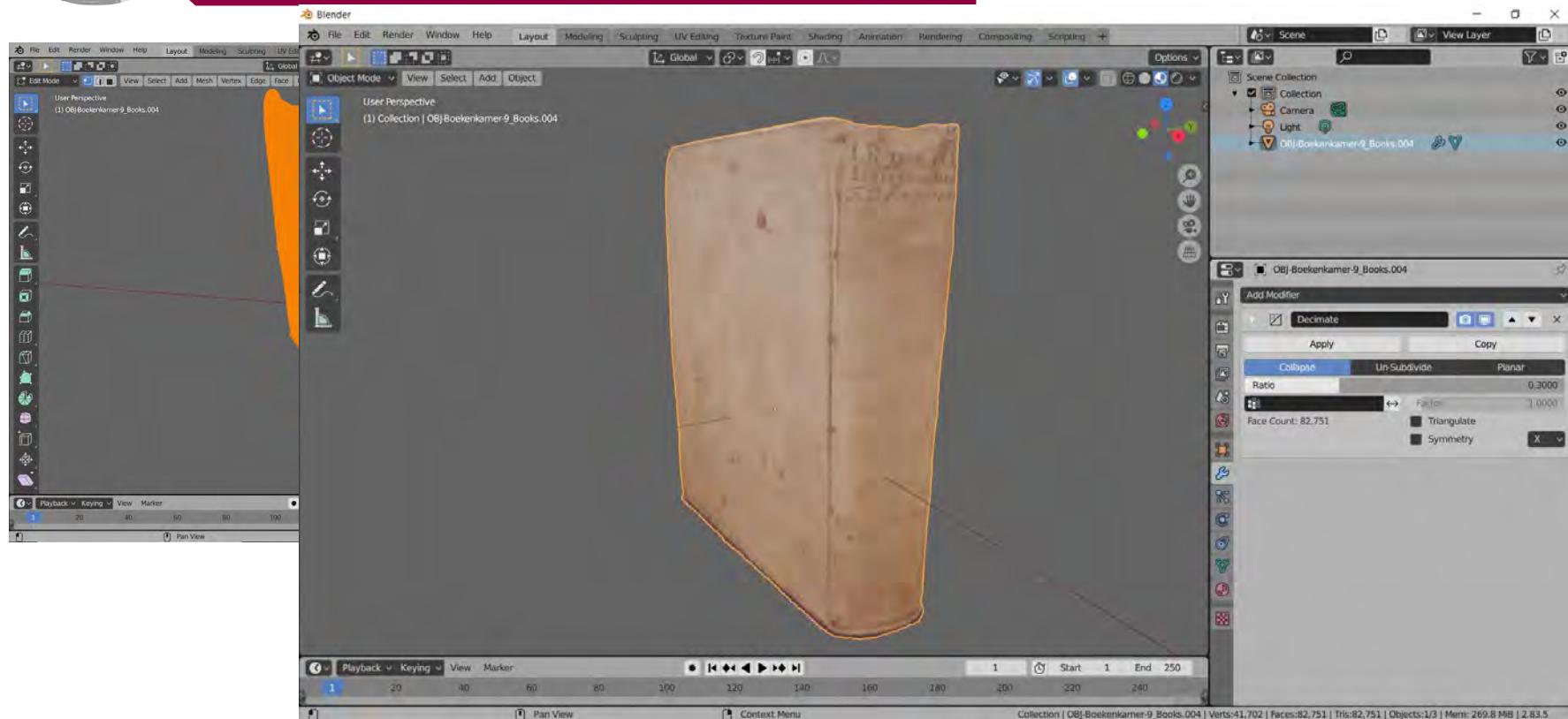
## Image-based modelling (high res) for a few books



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## Image-based modelling (high res) for a few books





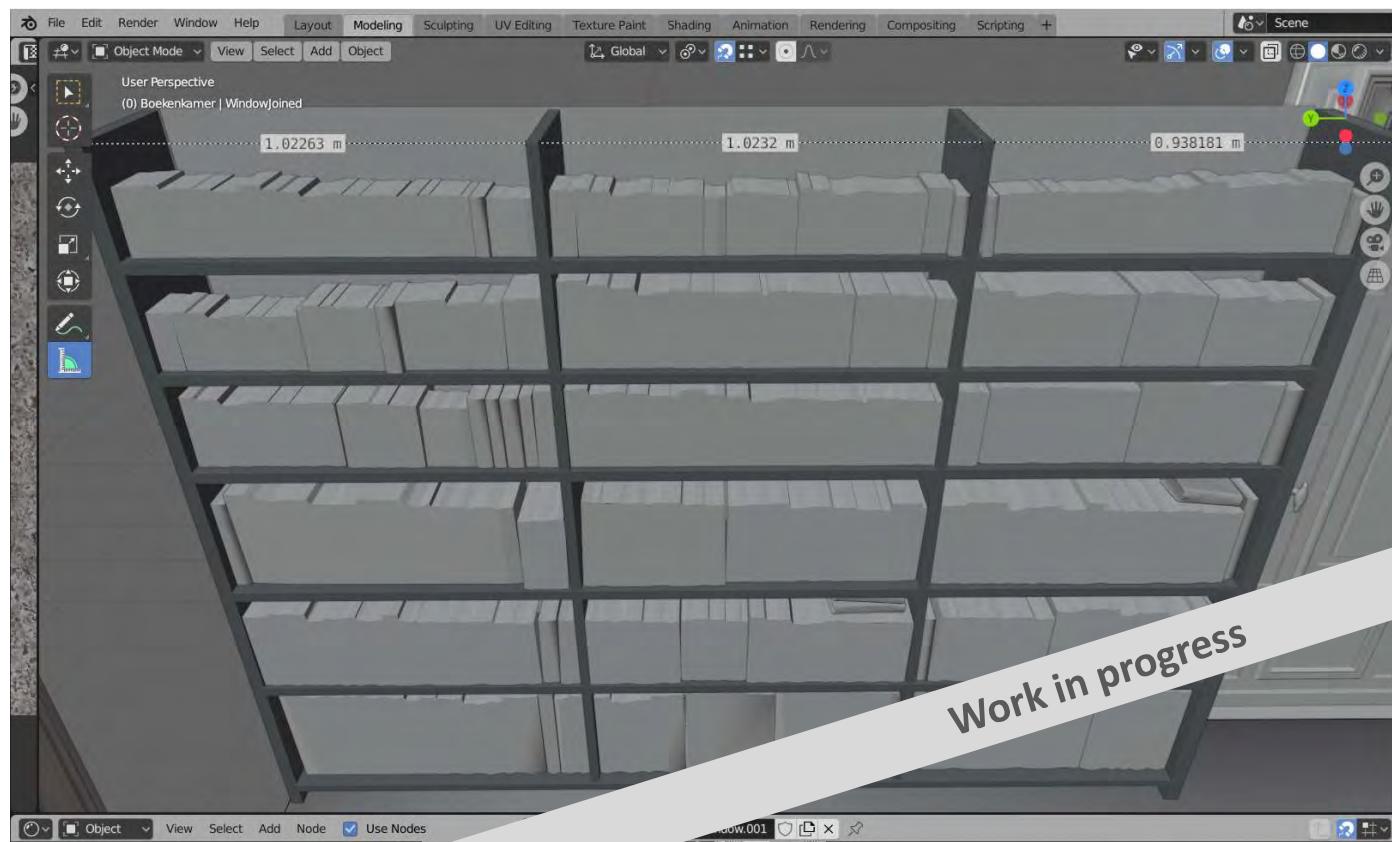
## Manual modelling in Blender (low-poly) for the hundreds of books on the shelves



From pictures of  
books kept at the  
Thysiana library  
(Leiden)

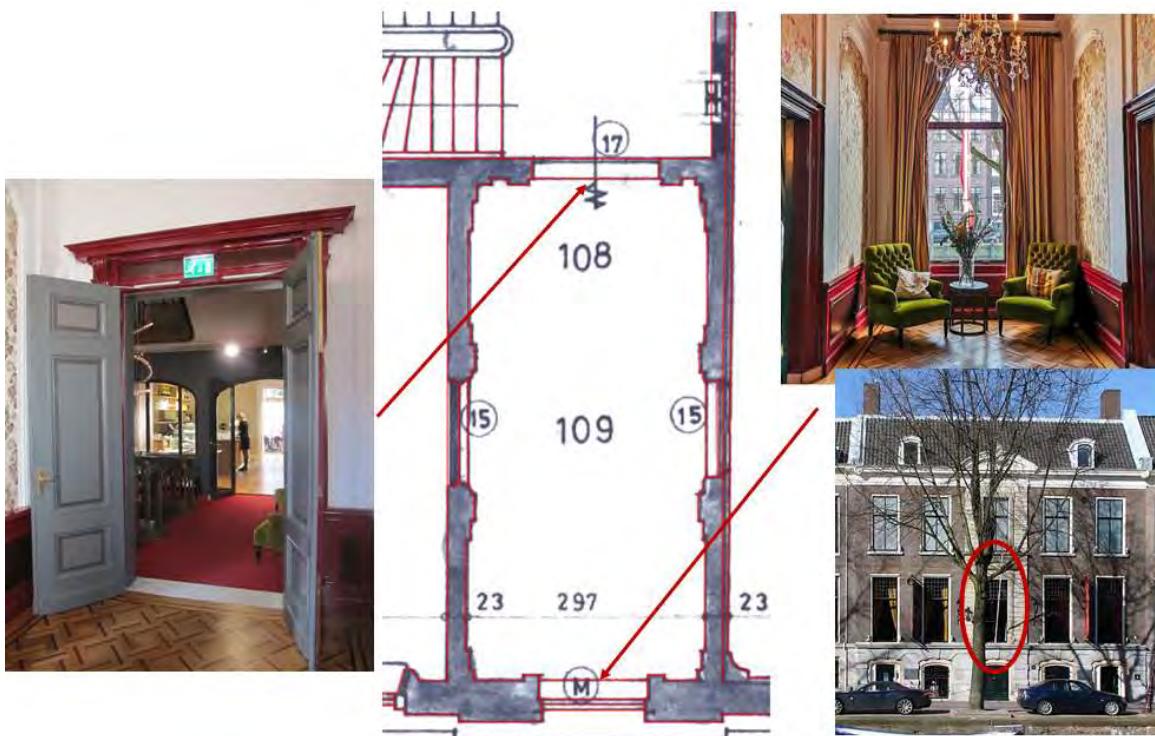
## De Graeff's private library

Estimating the available shelf space and hence the number of books



## Het Voorhuis

3D reconstruction to detect agency and visual hierarchy



C. Piccoli (forthcoming). 'Home-making in 17<sup>th</sup> century Amsterdam: A 3D reconstruction to investigate visual cues in the entrance hall of Pieter de Graeff (1638-1707)',  
in G. Landeschi and E. Betts (eds.), *Capturing the senses: digital methods for sensory archaeologies*, Springer.

# Het Voorhuis



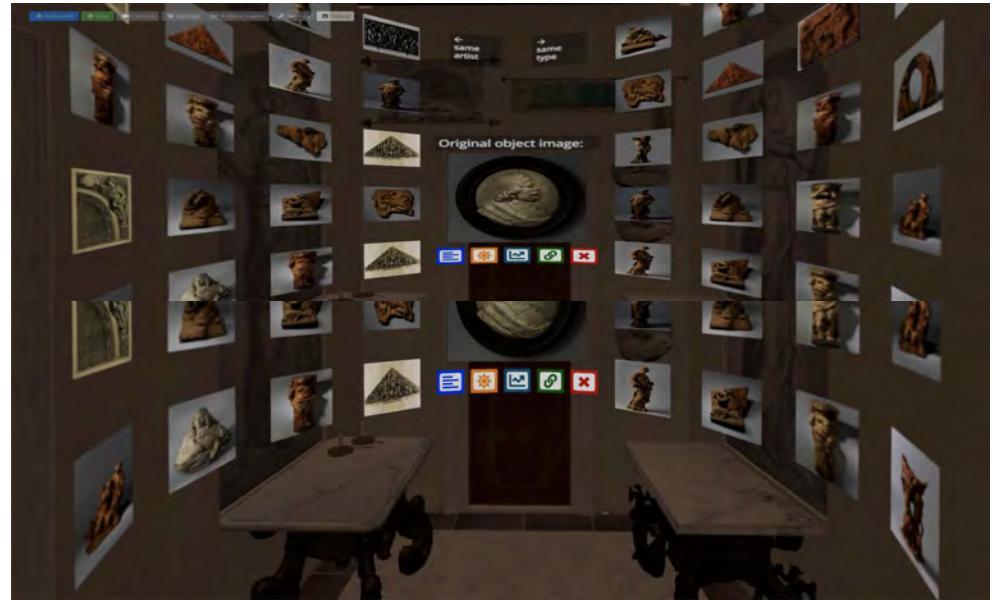
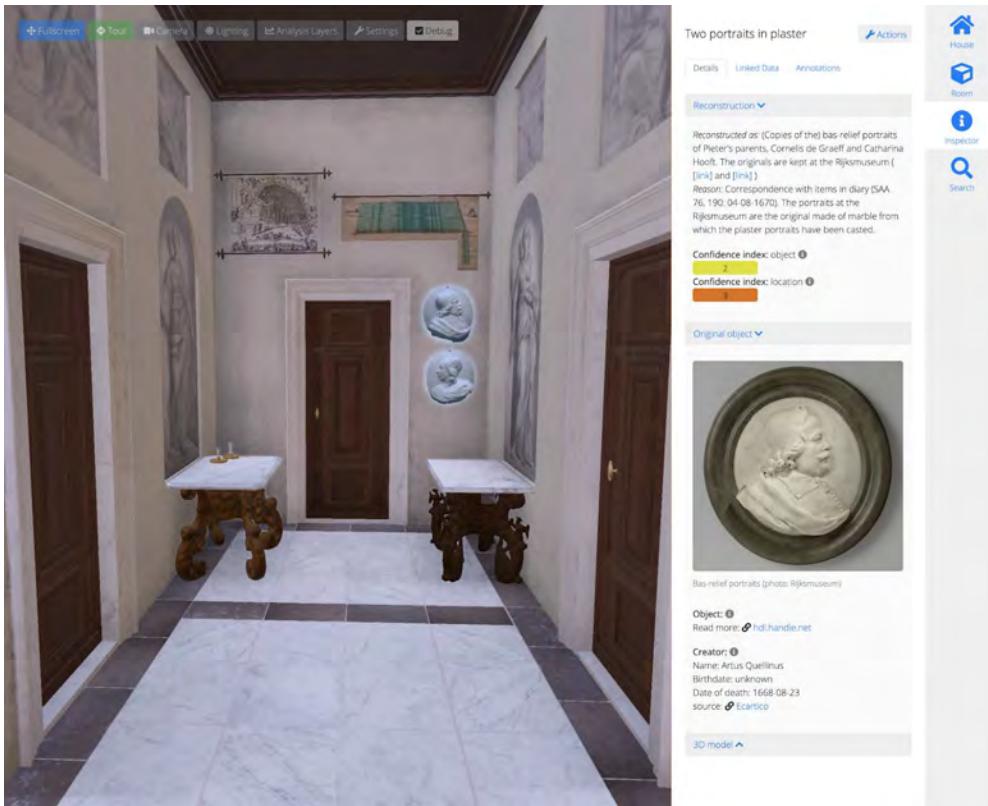
Transcription	Translation	Category	AAT_ID	Reconstructed as:	Reason:	Confidence index: Object 1 = original; 2 = primary source + analogy with certainty; 3 = primary source + analogy with doubt; 4 = uncertain	Confidence Index: Location 1 = known/in original location; 2 = inferred with certainty; 3 = inferred with doubt; 4 = uncertain
Twee papiere blakers	Two paper candle holders	Lighting	<a href="http://vocab.getty.edu/page/aat/30">http://vocab.getty.edu/page/aat/30</a>	Two candle holders (blakers).	Cf. SAA 210: 24-01-1690. Alternatively, these candle holders could refer to A map preserved in De Graeff family archive made by Johannes Leupenius in 1668 and Map of Zuid-Polsbroek made by Johannes Leupenius in 1668 and Amsteldam closer to the time in which the inventory was drawn up	3	3
Een kaart van Zuid Polsbroek.	A map of Zuid-Polsbroek	Map	<a href="http://vocab.getty.edu/page/aat/30">http://vocab.getty.edu/page/aat/30</a>	Map of Zuid-Polsbroek made by Johannes Leupenius in 1668 and Amsteldam closer to the time in which the inventory was drawn up	2	2	
Een d[it]o van Amsterdam	A map of Amsterdam	Map	<a href="http://vocab.getty.edu/page/aat/30">http://vocab.getty.edu/page/aat/30</a>	Map of Amsterdam closer to the time in which the inventory was drawn up	3	2	
Een eeken taaffel met een marmerblad	An oak table with a marble top	Furniture-table	<a href="http://vocab.getty.edu/page/aat/30">http://vocab.getty.edu/page/aat/30</a>	Side table with marble top and wooden foot in auricular style (ca. 1650-1675)	Correspondence of period style and decoration (cupids) that fit well The identification fits with the characteristics of the item in the Correspondence of period style and same location (entrance hall)	2 [top]; 3 [foot]	2
Een Smirnase plus gordijn	A curtain from Izmir	Textile-curtain	<a href="http://vocab.getty.edu/page/aat/30">http://vocab.getty.edu/page/aat/30</a>	17th century Ottoman velvet	The identification fits with the characteristics of the item in the Correspondence of period style and same location (entrance hall)	3	1
Een gesneden bank	A carved wooden bench	Furniture-bench	<a href="http://vocab.getty.edu/page/aat/30">http://vocab.getty.edu/page/aat/30</a>	The miniature wooden carved bench in the 'Voorhuis' of Petronella Oortman's	Correspondence of period style and same location (entrance hall)	2	2
Een marmore taaffel met een notebome voet	A marble table with a walnut foot	Furniture-table	<a href="http://vocab.getty.edu/page/aat/30">http://vocab.getty.edu/page/aat/30</a>	Side table with marble top and wooden foot in auricular style (ca. 1650-1675)	Correspondence of period style and decoration (cupids) sustaining two Pieter's parents, Cornelis de Graeff and	2 [top]; 3 [foot]	2
Twee pourtraicten van Pleysterwerk.	Two portraits in plaster	Sculpture	<a href="http://vocab.getty.edu/page/aat/30">http://vocab.getty.edu/page/aat/30</a>	(Copies of the bas-relief portraits of Pieter's parents, Cornelis de Graeff and	Correspondence with items in diary (SAA 76, 190: 04-08-1670). The	3	3



Recording the decision-making process and visualizing the uncertainty

## Prototype Desktop and VR application

A desktop and VR web-viewer designed and implemented by Hugo Huerdeman allows users to explore the 3D reconstructions, the underlying data sources and linked datasets through semantic queries



More info: <https://virtualinteriorsproject.wordpress.com/hyperspaces-for-research-interfaces-and-enhanced-publications/>

H. Huerdeman and C. Piccoli, '3D reconstructions as research hubs: Geospatial interfaces for real-time data exploration of 17th century Amsterdam domestic interiors' (under review)

## 3D modelling historic interiors for the *Virtual Interiors* project

### Discussion

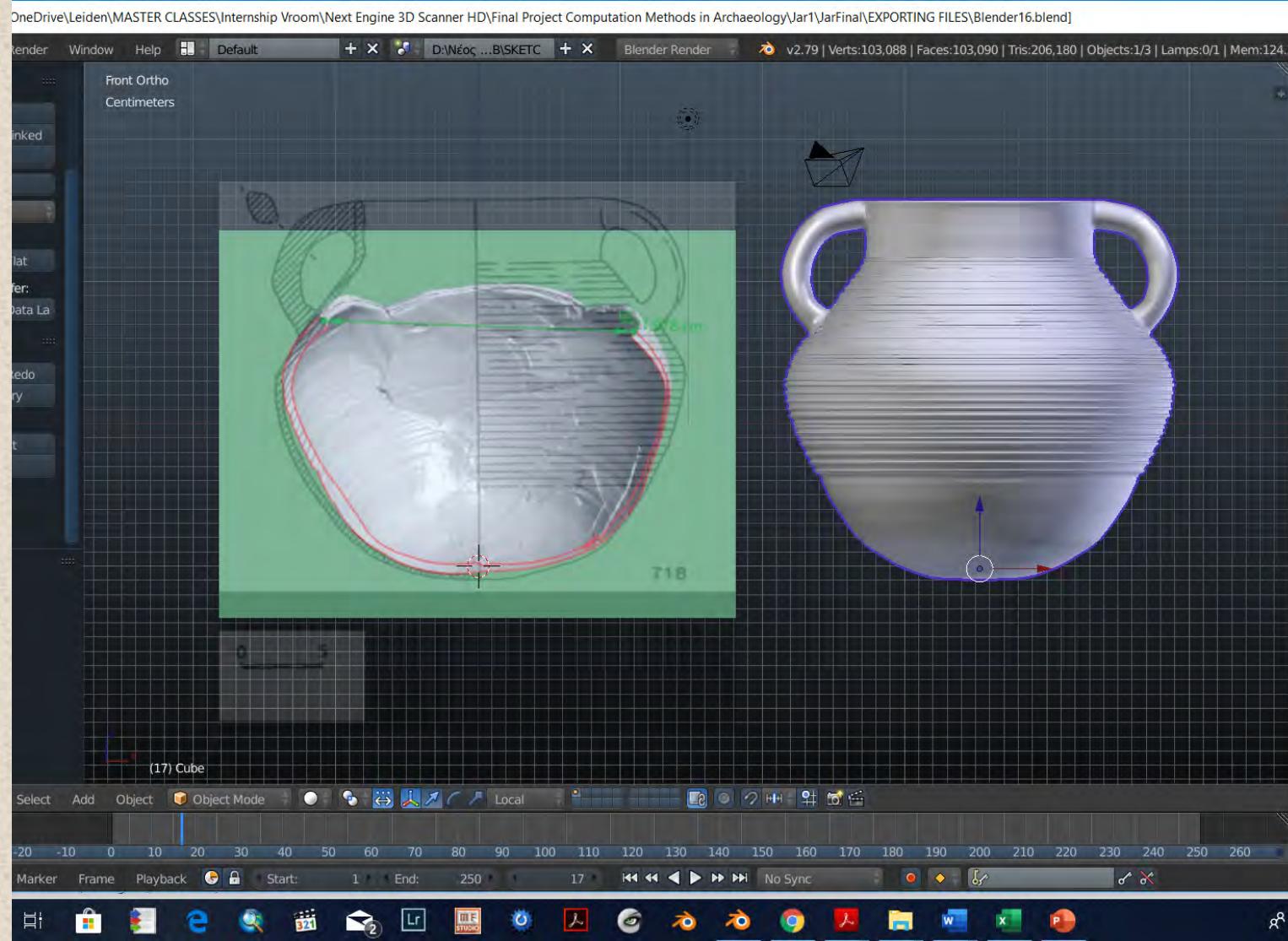
3D reconstruction = A ‘virtual laboratory’ to:

- Visualize lost building phases and room functions in a non-destructive way
- “Materialize” household objects in their spatial context
- Expose associations of objects, and correlations of objects and locations
- Investigate spatial properties, visual prominence and agency
- Structure heterogeneous data and make them accessible

## Acknowledgements:

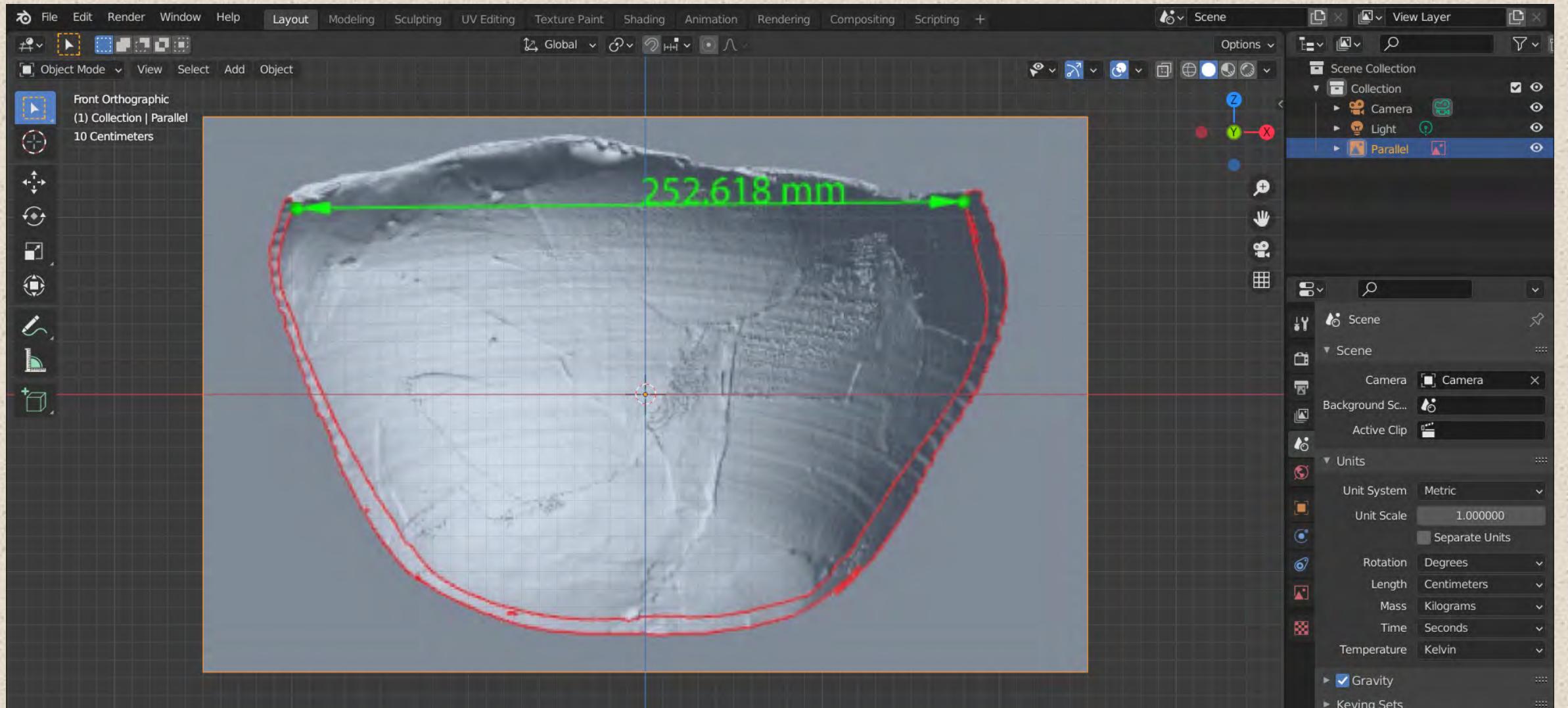
Gabri van Tussenbroek - Bart Reuvekamp - Paul Hoftijzer - Hugo Huurdeman  
Judith Brouwer - Julia Noordegraaf - Charles van den Heuvel - Weixuan Li  
Monument and Archaeology Office, Amsterdam



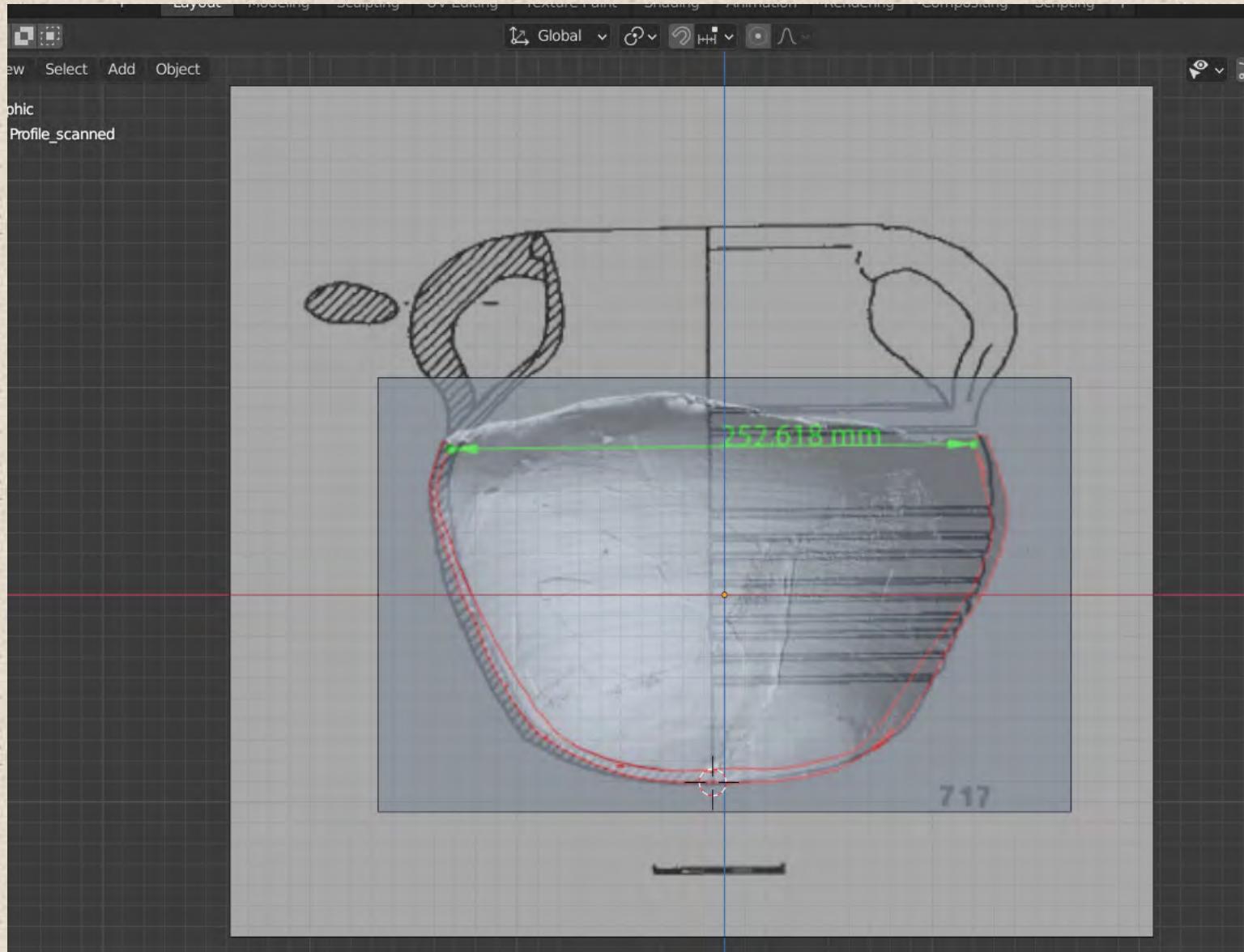


# BLENDER SOFTWARE POT RECONSTRUCTION



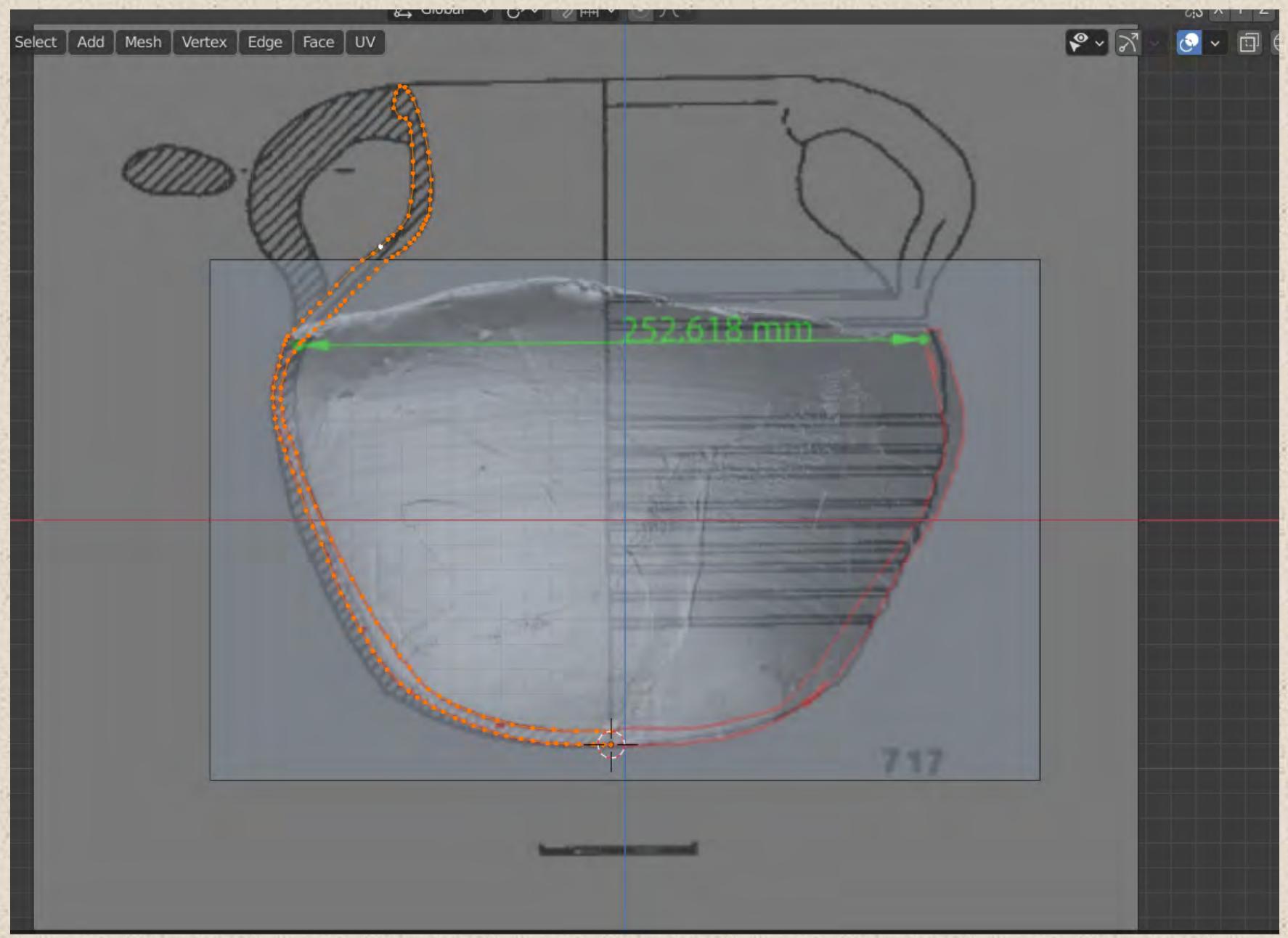


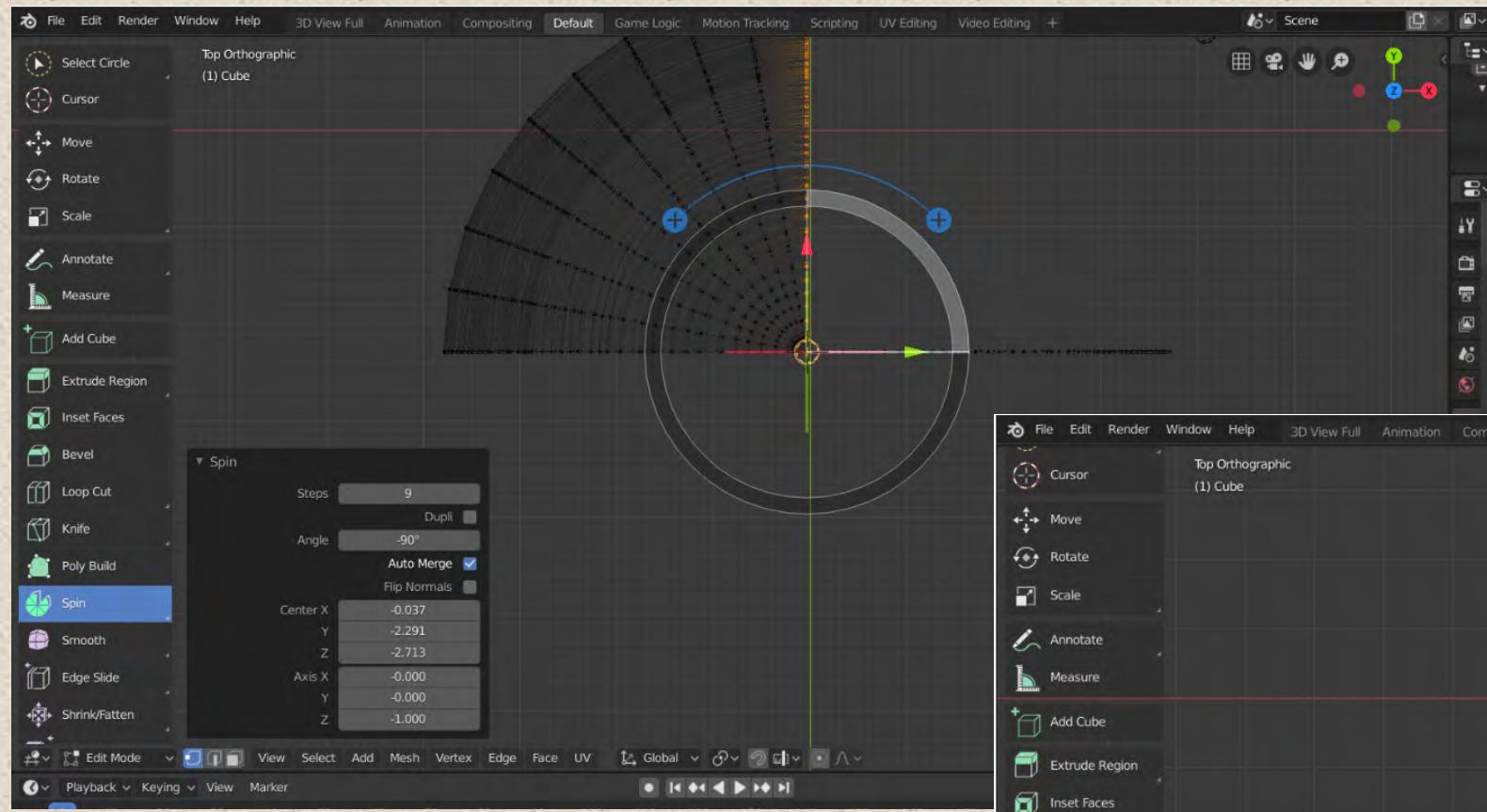
Applying the correct measurements and the right metric system is the first important step which is achieved by using the original preserved profile of our vessel.



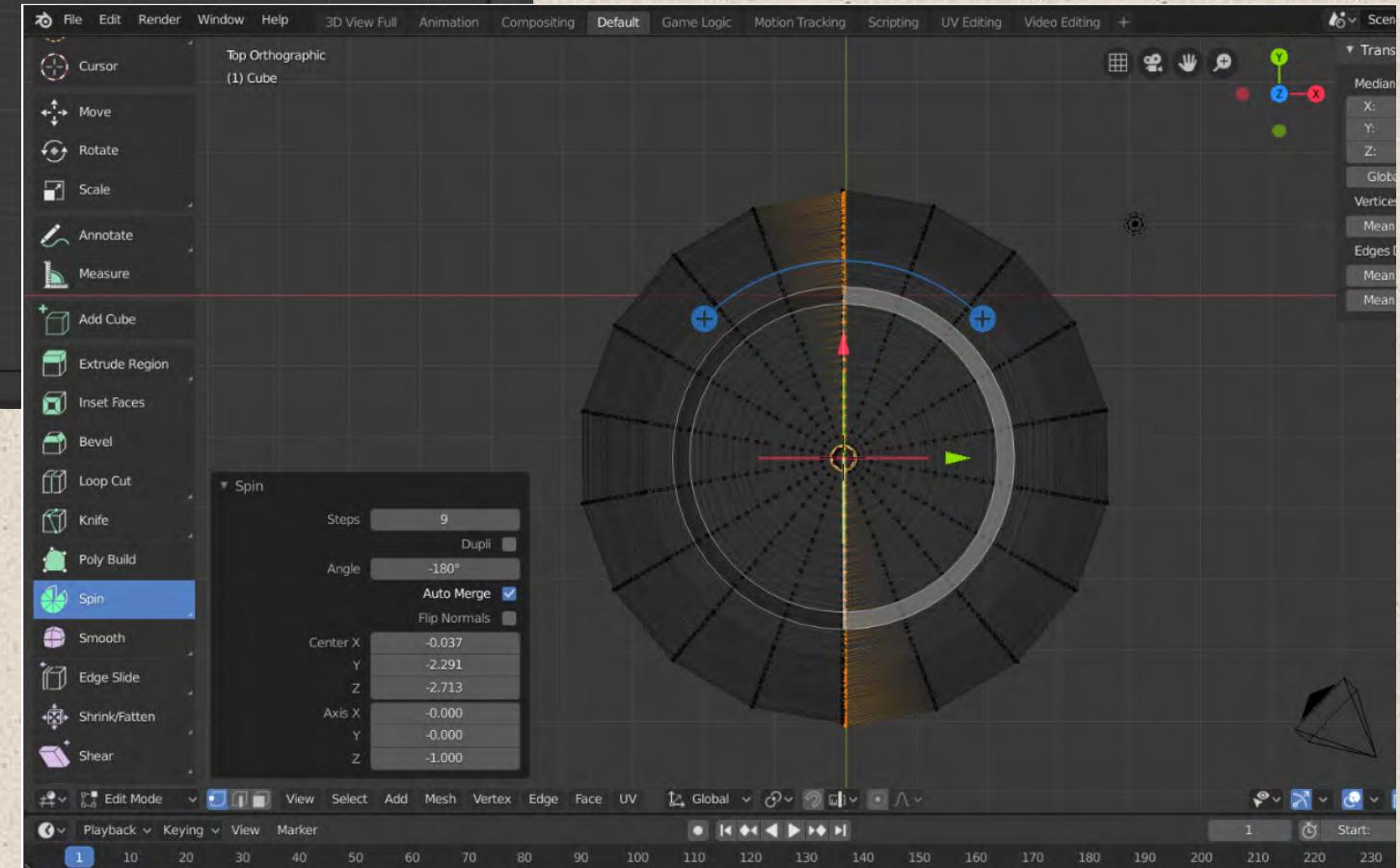
We import also the drawing of the parallel profile and adjust it in a way that matches the original one.

Outlining the profile follows.

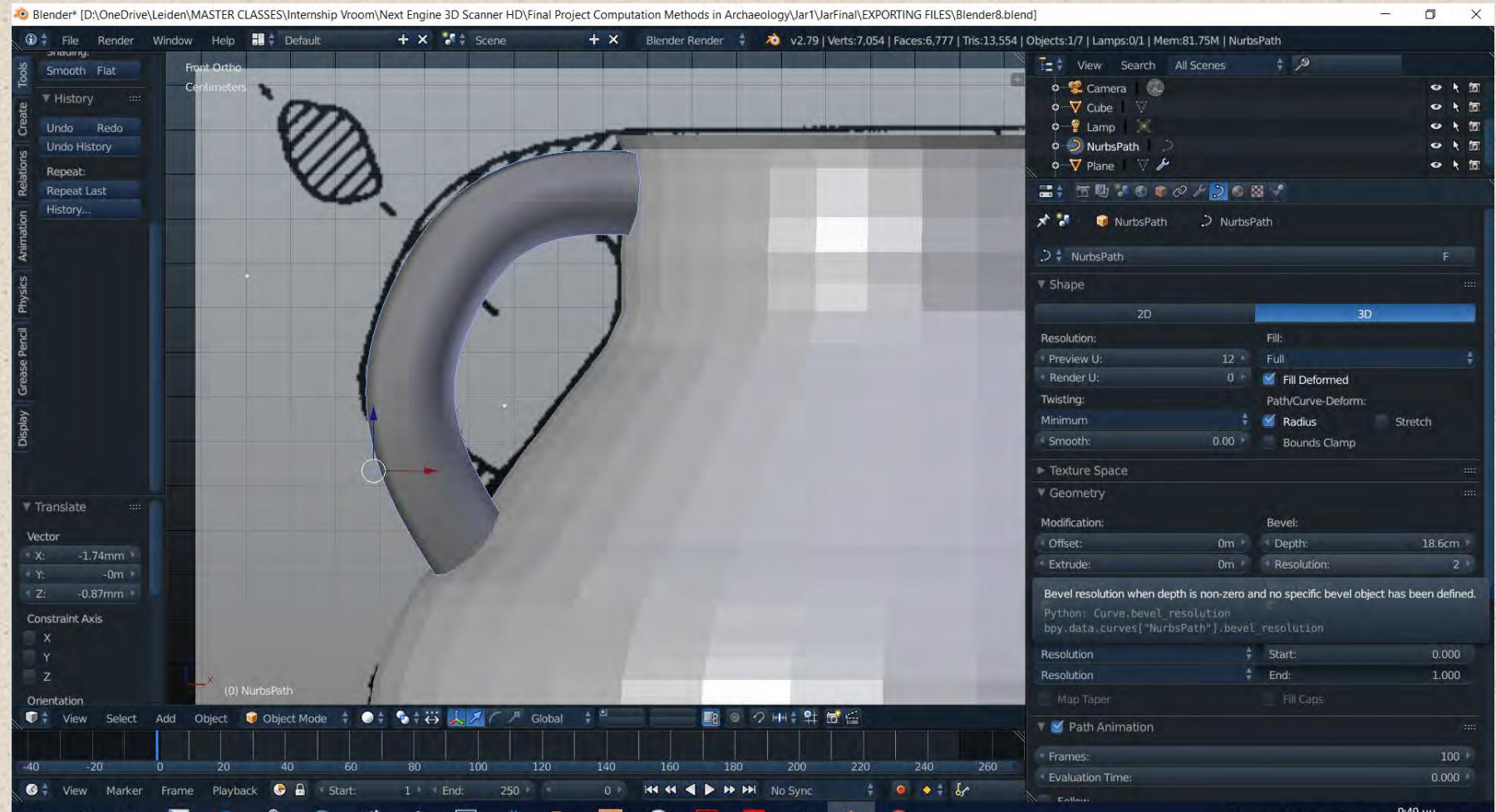




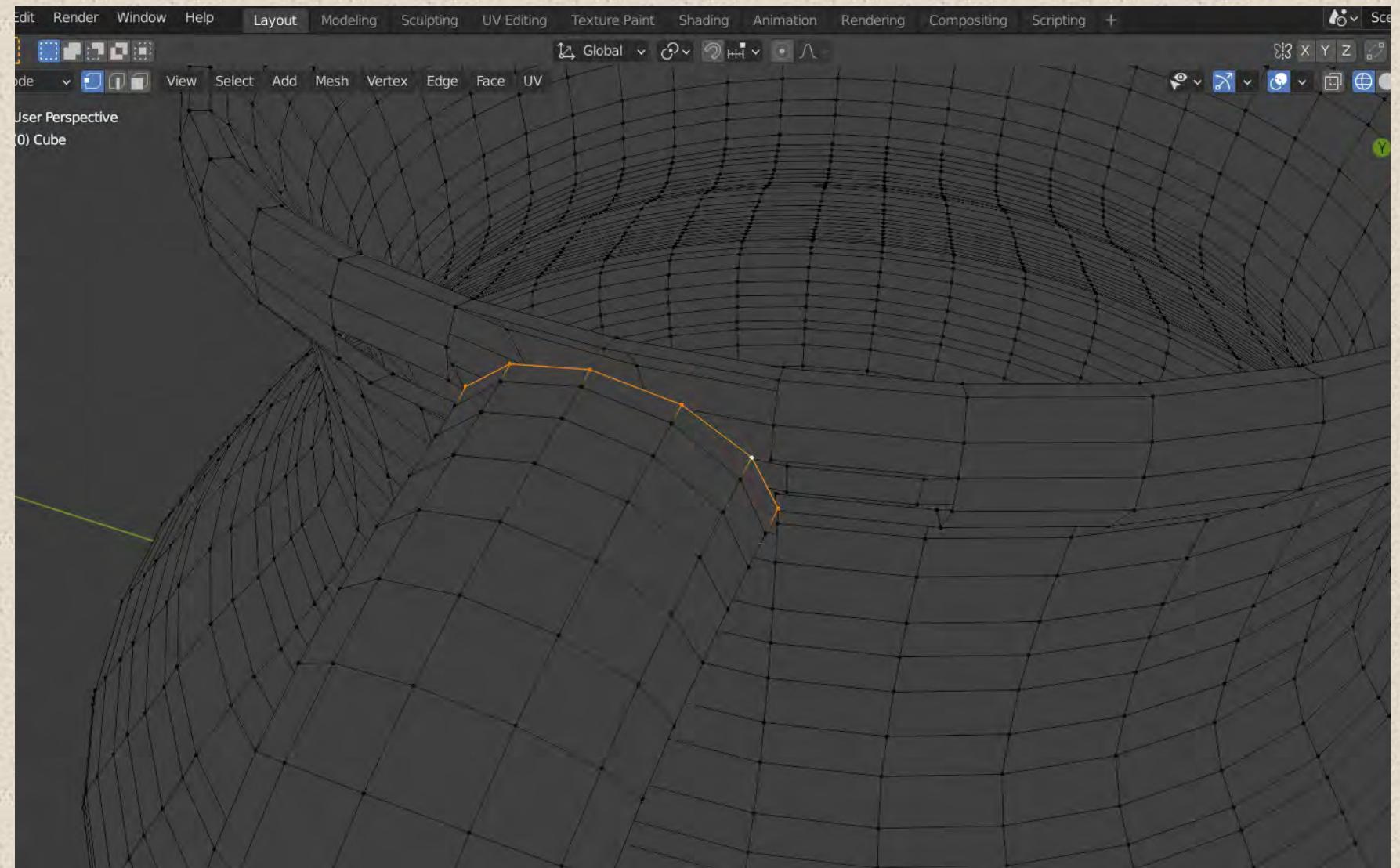
Spinning command in order to acquire the main body of the pots.



# Creation of the handle using the Path Curve.

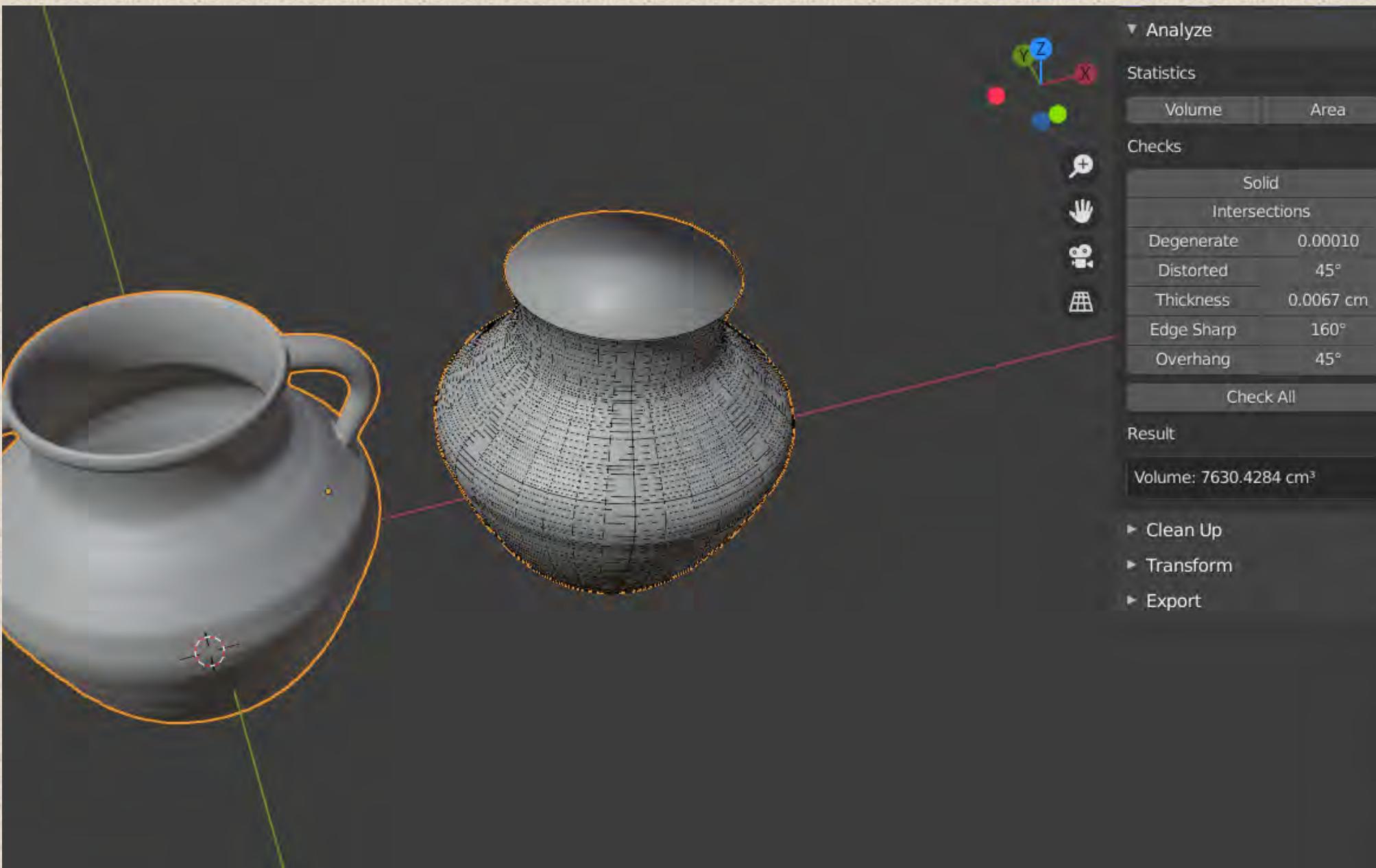


Adjusting it on the vessel.





Selecting the Symmetrize option or the Mirror modifier in order to add the exact same handle on the right side of the vessel.



Calculating the Volume of the vessel