

# Introducción a la Fotogrametría Digital

---

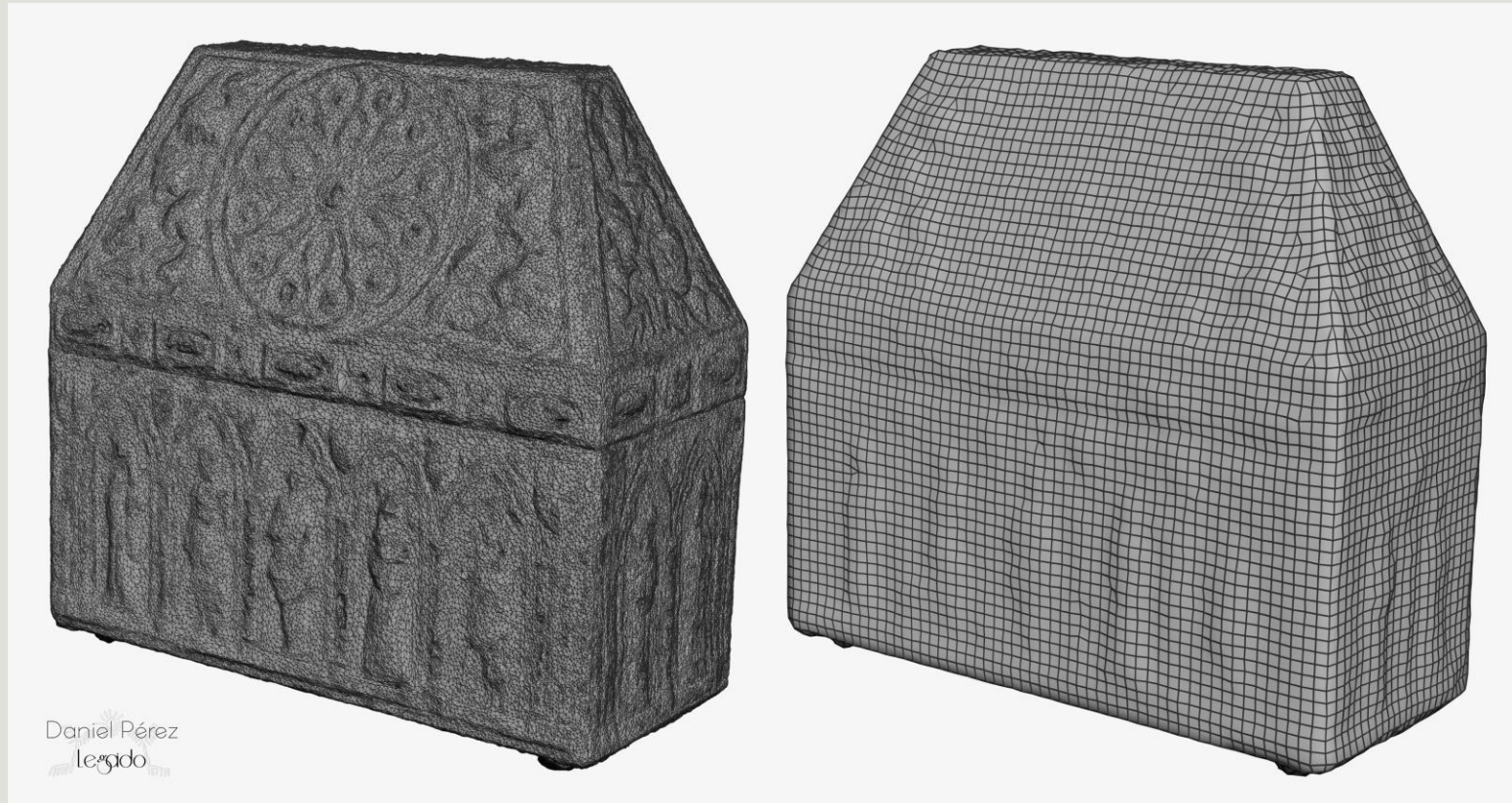
EDITANDO NUESTRO MODELO 3D



# Optimización 3D

---

Modelo 3D **detallado** vs modelo 3D **optimizado**



# Optimización 3D

Modelo 3D **detallado** vs modelo 3D **optimizado**



Daniel Pérez  
legado

# MODELO EXPORTADO / MODELO DETALLADO

Formato **.obj** (+.mtl) o **.fbx**

**+ textura**



Escudo\_Villacabuey



Escudo\_Villacabuey



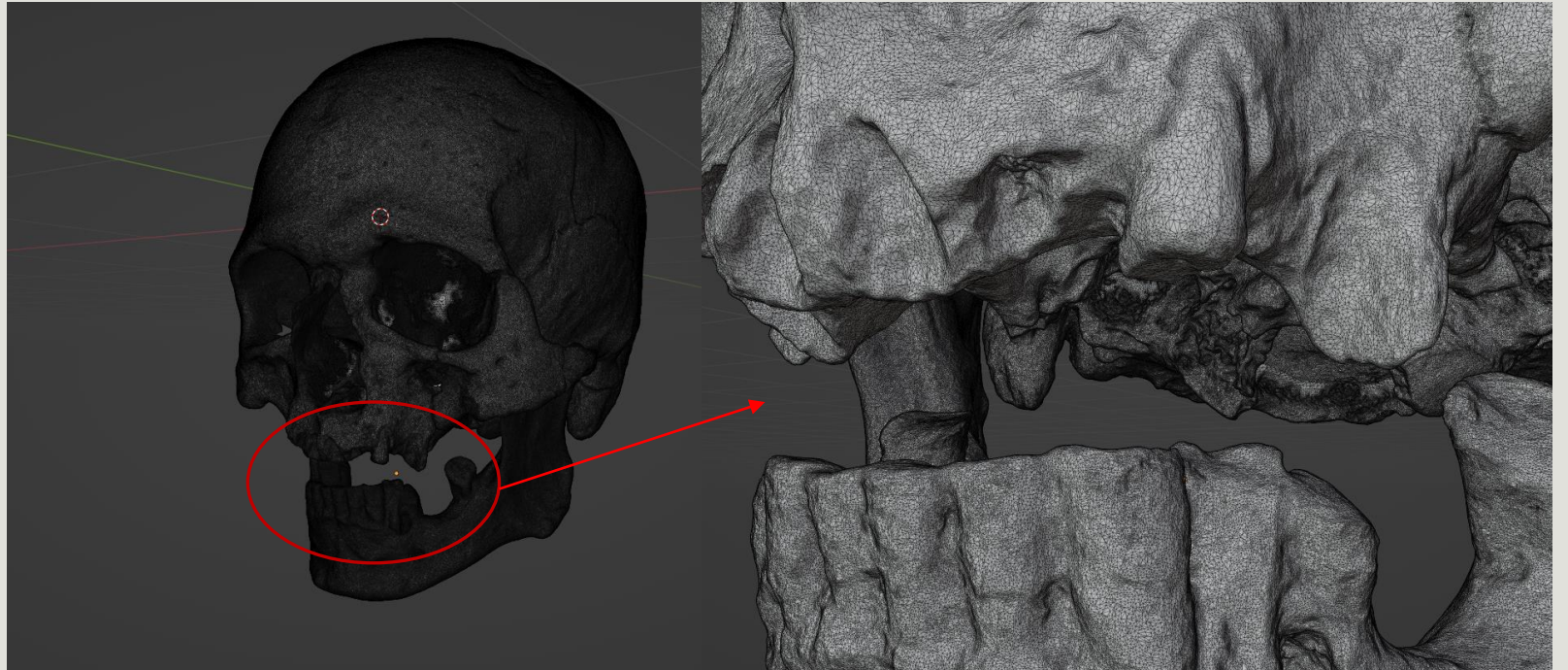
Escudo\_Villacabuey



# Optimización 3D

## Modelo 3D detallado

- Más rápido de generar
- Gran número de polígonos
- Elevado peso de archivo
- Utilidades:
  - Documentación
  - Estudio
  - Medición

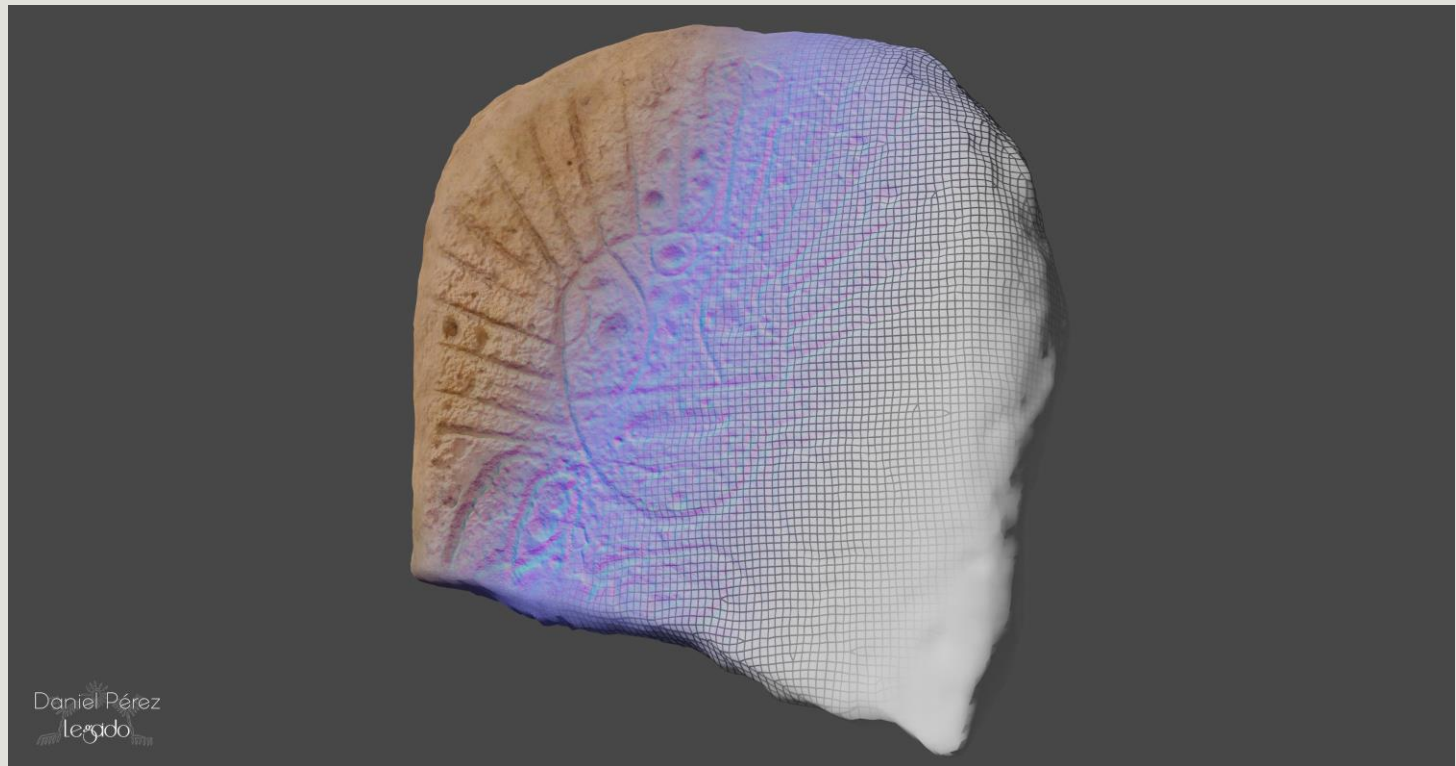


# Optimización 3D

---

## Modelo 3D optimizado

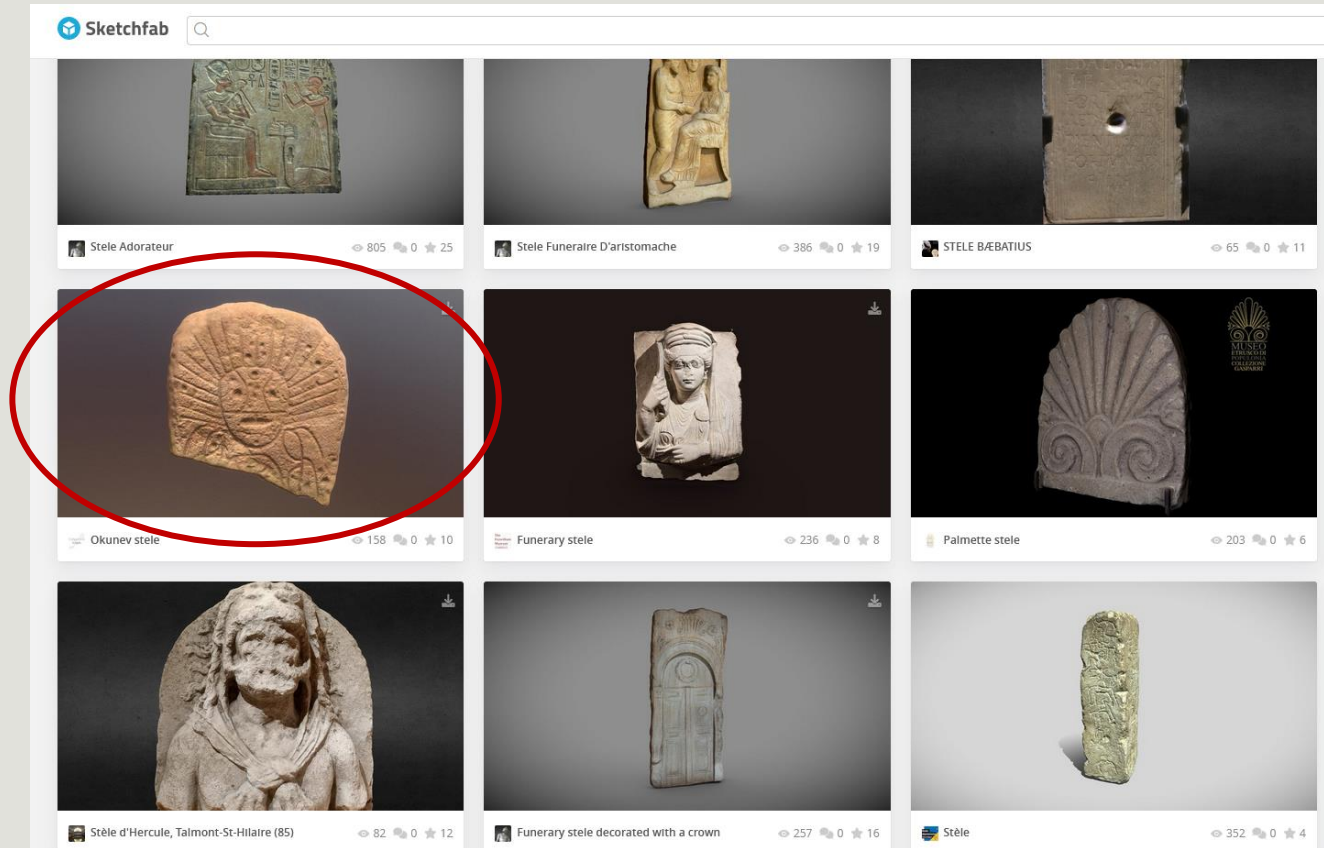
- Más tiempo de trabajo
- Bajo número de polígonos
- Bajo peso de archivo
- Utilidades:
  - Difusión
  - Visualización



# Optimización 3D

## Modelo 3D optimizado

- Más tiempo de trabajo
- Bajo número de polígonos
- Bajo peso de archivo
- Utilidades:
  - Difusión
  - Visualización



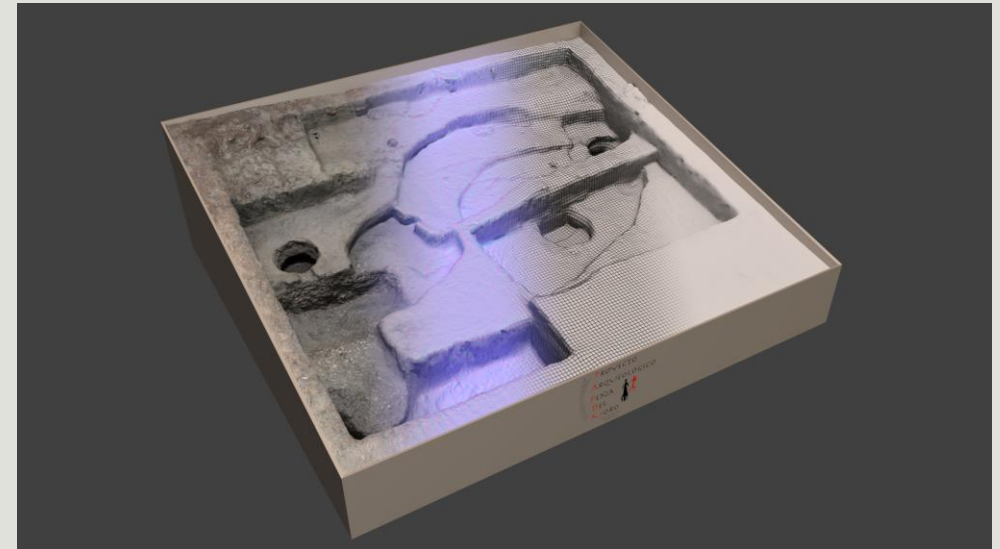
# Optimización 3D

---

Modelo detallado vs modelo optimizado



Archivo .obj + textura: 293 mb



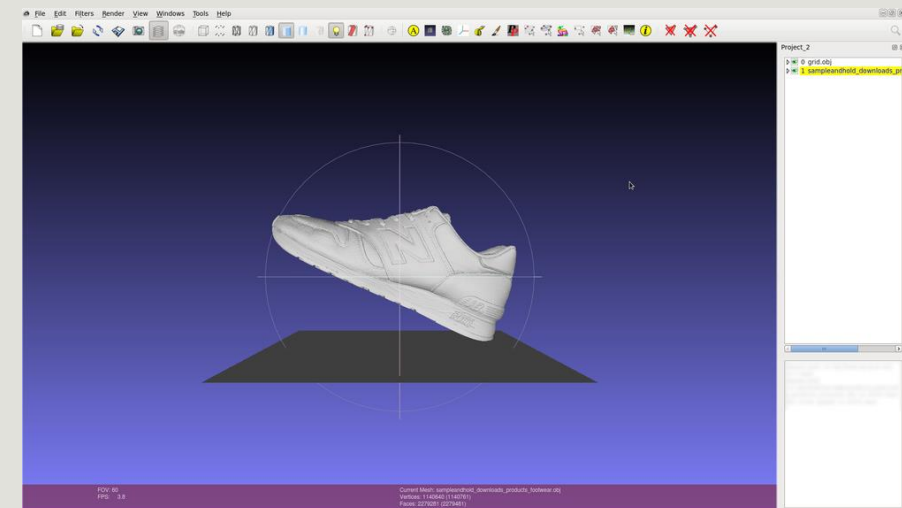
Archivo .obj + mapas de textura: 45 mb



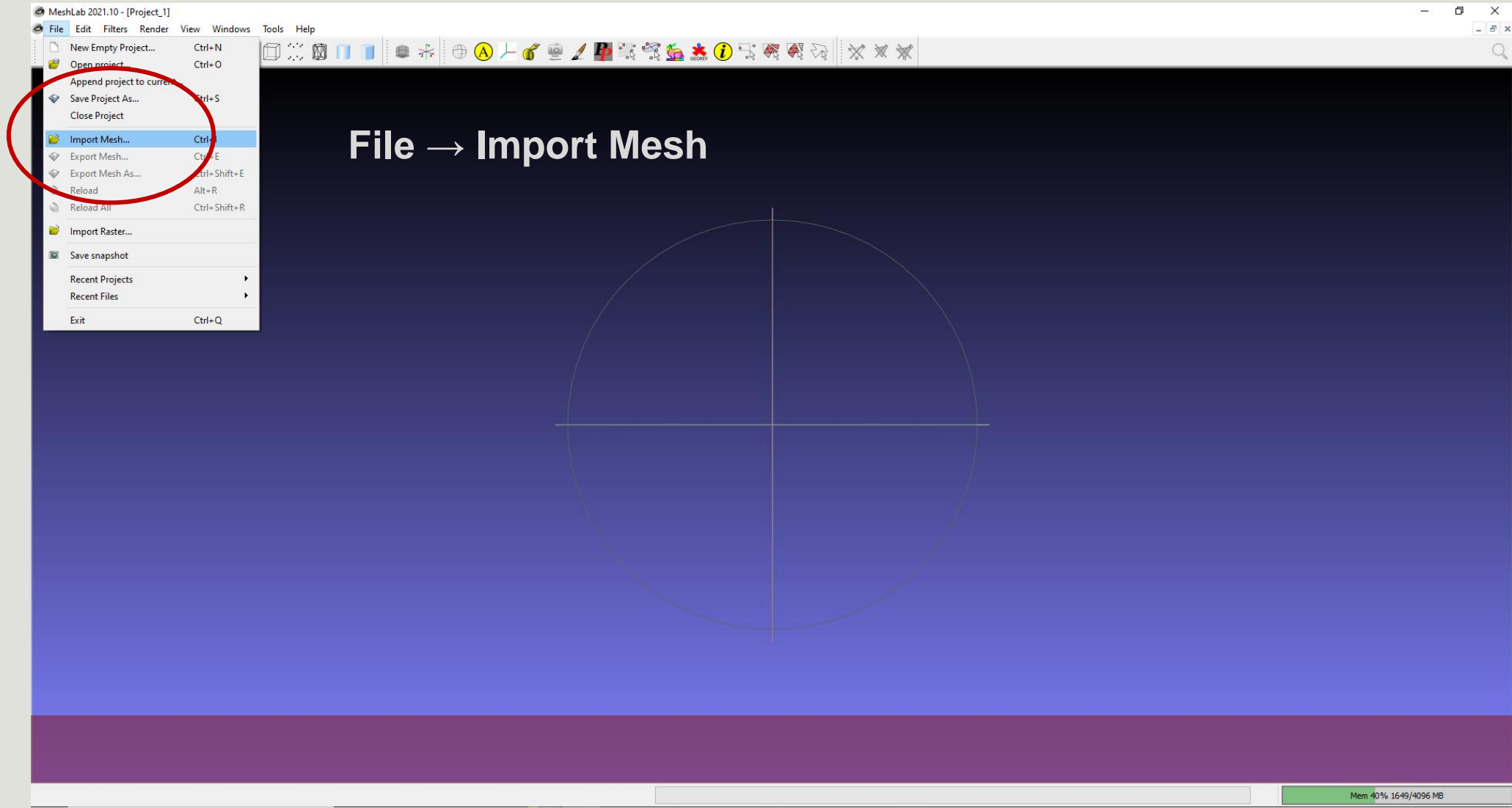
# Softwares de edición 3D

## Meshlab: ¿Qué podemos hacer con él?

- Edición y procesado de modelos 3D
- Alineamiento de nubes de puntos
- Visualización y presentación de modelos 3D
- Reconstrucción de geometrías a partir de nubes de puntos
- Escalado y orientación de modelos 3D
- Simplificado y refinado de geometrías
- Herramientas de medida



# Meshlab: Decimado



¡Cuidado con los nombres de los modelos!

# Meshlab: Decimado

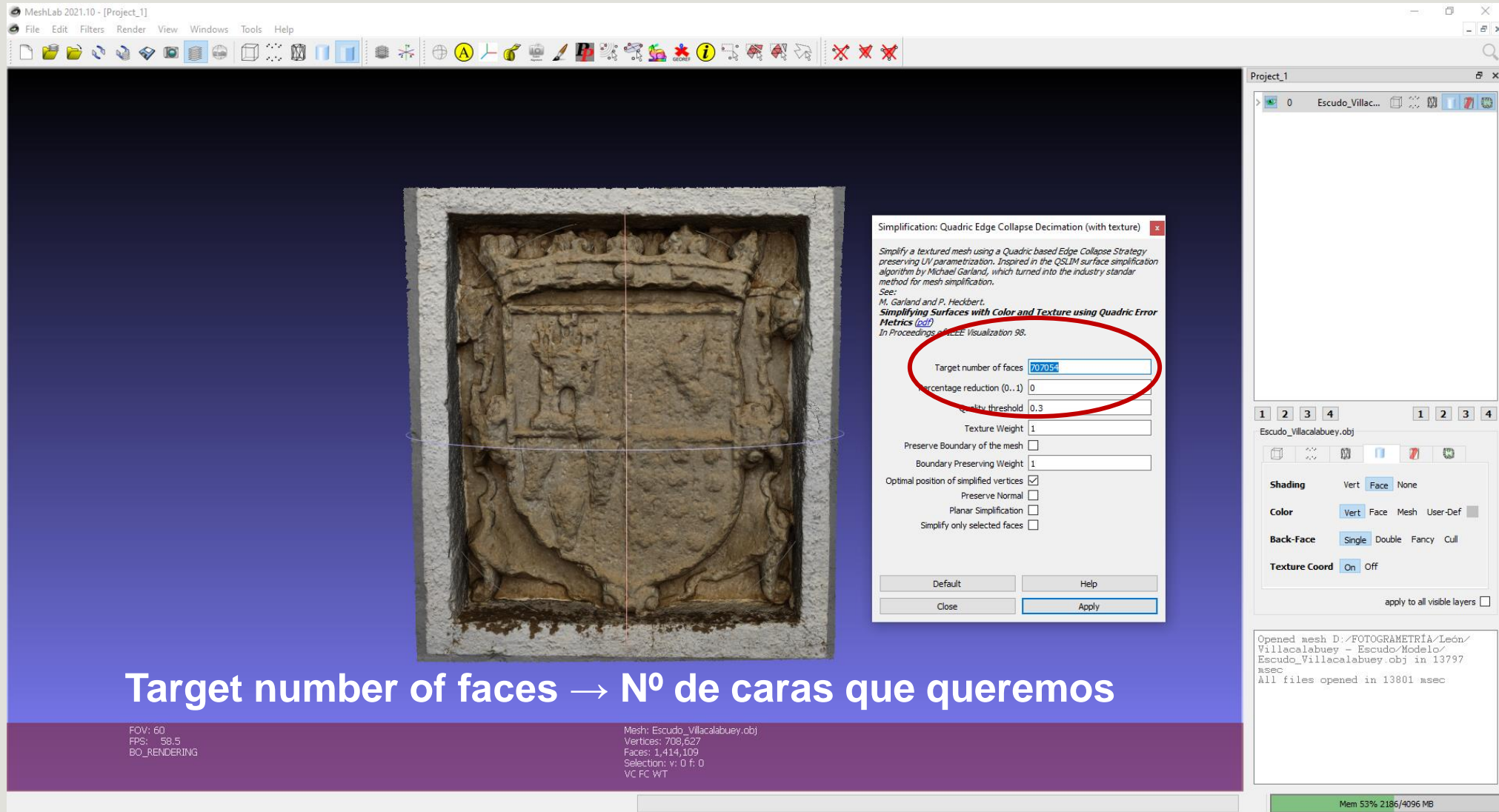
The screenshot displays the MeshLab 2021.10 interface. The 'Filters' menu is open, showing a list of operations. A yellow box labeled 'Filters' with a downward arrow points to a larger yellow box labeled 'Remeshing, Simplification and Reconstruction'. Another yellow box labeled 'Simplification: Quadric Edge Collapse Decimation (With Texture)' with a downward arrow points to a third yellow box labeled 'Texture)'. The 'Filters' list includes:

- Alpha Complex/Shape
- Build a Polyline from Selected Edges
- Close Holes
- Convex Hull
- Create Solid Wireframe
- Curvature flipping optimization
- Cut mesh along crease edges
- Generate Scalar Harmonic Field
- Global Align Meshes
- ICP Between Meshes
- Iso Parametrization Build Atlased Mesh
- Iso Parametrization Remeshing
- Iso Parametrization transfer between meshes
- Iso Parametrization: Main
- Marching Cubes (APSS)
- Marching Cubes (RIMLS)
- Merge Close Vertices
- Mesh Boolean: Difference
- Mesh Boolean: Intersection
- Mesh Boolean: Symmetric Difference (XOR)
- Mesh Boolean: Union
- Planar flipping optimization
- Points Cloud Movement
- Refine User-Defined
- Remeshing: Isotropic Explicit Remeshing
- Remove Duplicate Faces
- Remove Duplicate Vertices
- Remove Isolated Folded Faces by Edge Flip
- Remove Isolated pieces (wrt Diameter)
- Remove Isolated pieces (wrt Face Num.)
- Remove T-Vertices
- Remove Unreferenced Vertices
- Remove Vertices wrt Quality
- Remove Zero Area Faces
- Repair non Manifold Edges
- Repair non Manifold Vertices by splitting
- Select Crease Edges
- Simplification: Clustering Decimation
- Simplification: Edge Collapse for Marching Cube m
- Simplification: Quadric Edge Collapse Decimation (FilterMeshing)
- Simplification: Quadric Edge Collapse Decimation (with texture)
- Snap Mismatched Borders
- Subdivision Surfaces: Butterfly Subdivision
- Subdivision Surfaces: Catmull-Clark
- Subdivision Surfaces: LS3 Loop
- Subdivision Surfaces: Loop
- Subdivision Surfaces: Midpoint
- Surface Reconstruction: Screened Poisson
- Surface Reconstruction: VCG
- Tri to Quad by 4-8 Subdivision
- Tri to Quad by smart triangle pairing
- Turn into Quad-Dominant mesh
- Turn into a Pure-Triangular mesh
- Uniform Mesh Resampling
- Vertex Attribute Seam
- Voronoi Filtering

At the bottom of the interface, a status bar shows 'Mem 52% 2170/4096 MB'. A red warning message at the bottom of the slide reads: '¡Cuidado con los nombres de los modelos!'.

¡Cuidado con los nombres de los modelos!

# Meshlab: Decimado



MeshLab 2021.10 - [Project\_1]

File Edit Filters Render View Windows Tools Help

Project\_1

Escudo\_Villac...

Escudo\_Villacalabuey.obj

Shading Vert Face None

Color Vert Face Mesh User-Def

Back-Face Single Double Fancy Cull

Texture Coord On Off

apply to all visible layers

Opened mesh D:/FOTOGRAMETRIA/León/Villacalabuey - Escudo/Modelo/Escudo\_Villacalabuey.obj in 13797 msec  
All files opened in 13801 msec

Mem 53% 2186/4096 MB

Simplification: Quadric Edge Collapse Decimation (with texture)

Simplify a textured mesh using a Quadric based Edge Collapse Strategy preserving UV parametrization. Inspired in the QSLM surface simplification algorithm by Michael Garland, which turned into the industry standard method for mesh simplification.

See:  
M. Garland and P. Heckbert,  
**Simplifying Surfaces with Color and Texture using Quadric Error Metrics** (pdf)  
In Proceedings of IEEE Visualization 98.

Target number of faces: 707054

Percentage reduction (0..1): 0

Quality threshold: 0.3

Texture Weight: 1

Preserve Boundary of the mesh:

Boundary Preserving Weight: 1

Optimal position of simplified vertices:

Preserve Normal:

Planar Simplification:

Simplify only selected faces:

Default Help

Close Apply

FOV: 60  
FPS: 58.5  
BO\_RENDERING

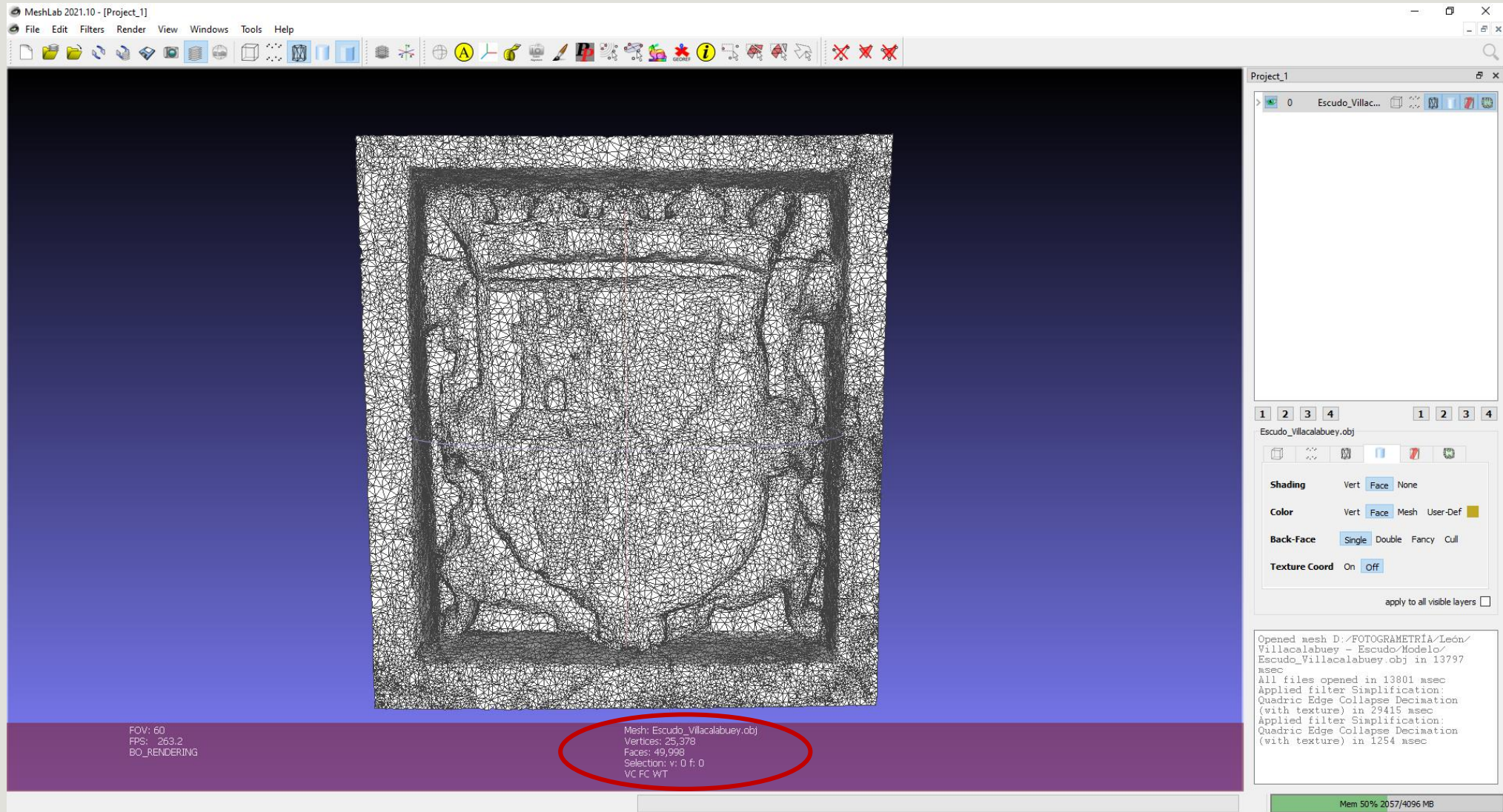
Mesh: Escudo\_Villacalabuey.obj  
Vertices: 708,627  
Faces: 1,414,109  
Selection: v: 0 f: 0  
VC FC WT

Target number of faces → N° de caras que queremos

¡Cuidado con los nombres de los modelos!



# Meshlab: Decimado



¡Cuidado con los nombres de los modelos!

# Meshlab: Decimado

**File → Export Mesh As...**

MeshLab 2021.10 - [Project\_1]

File Edit Filters Render View Windows Tools Help

- New Empty Project... Ctrl+N
- Open project... Ctrl+O
- Append project to current...
- Save Project As... Ctrl+S
- Close Project
- Import Mesh... Ctrl+I
- Export Mesh... Ctrl+E
- Export Mesh As... Ctrl+Shift+E**
- Reload Alt+R
- Reload All Ctrl+Shift+R
- Import Raster...
- Save snapshot
- Recent Projects
- Recent Files
- Exit Ctrl+Q

Project\_1

Escudo\_Villacabuey.obj

Shading Vert Face None

Color Vert Face Mesh User-Def

Back-Face Single Double Fancy Cull

Texture Coord On Off

apply to all visible layers

Opened mesh D:/FOTOGRAMETRIA/León/Villacabuey - Escudo/Modelo/Escudo\_Villacabuey.obj in 13797 msec

All files opened in 13801 msec

Applied filter Simplification: Quadric Edge Collapse Decimation (with texture) in 29415 msec

Applied filter Simplification: Quadric Edge Collapse Decimation (with texture) in 1254 msec

FOV: 60  
FPS: 47.2  
BO\_RENDERING

Mesh: Escudo\_Villacabuey.obj  
Vertices: 25,378  
Faces: 49,998  
Selection: v: 0 f: 0  
VC FC WT

Mem 49% 2033/4096 MB

¡Cuidado con los nombres de los modelos!



# Meshlab: Decimado

The screenshot shows the MeshLab 2021.10 interface. A file save dialog is open, titled "Save 'Escudo\_Villacalabuey.obj' Layer". The dialog shows the file path: "FOTOGRAMETRÍA > León > Villacalabuey - Escudo > Modelo". The file name is "Escudo\_Villacalabuey" and the type is "Stanford Polygon File Format (\*.ply)". The "Alias Wavefront Object (\*.obj)" option is selected and circled in red. The main window displays a 3D mesh of a shield. The right sidebar shows the "Project\_1" panel with a list of layers and a "Shading" panel with options for "Vert", "Face", and "None". The bottom status bar shows "Mem 49% 2044/4096 MB".

**Formato .obj**

FOV: 60  
FPS: 243.9  
BO\_RENDERING

Mesh: Escudo\_Villacalabuey.obj  
Vertices: 25,378  
Faces: 49,998  
Selection: v: 0 f: 0  
VC FC WT

```
Opened mesh D:/FOTOGRAMETRÍA/León/Villacalabuey - Escudo/Modelo/Escudo_Villacalabuey.obj in 13797 msec
All files opened in 13801 msec
Applied filter Simplification:
Quadric Edge Collapse Decimation
(with texture) in 29415 msec
Applied filter Simplification:
Quadric Edge Collapse Decimation
(with texture) in 1254 msec
```

¡Cuidado con los nombres de los modelos!

# Softwares de edición 3D

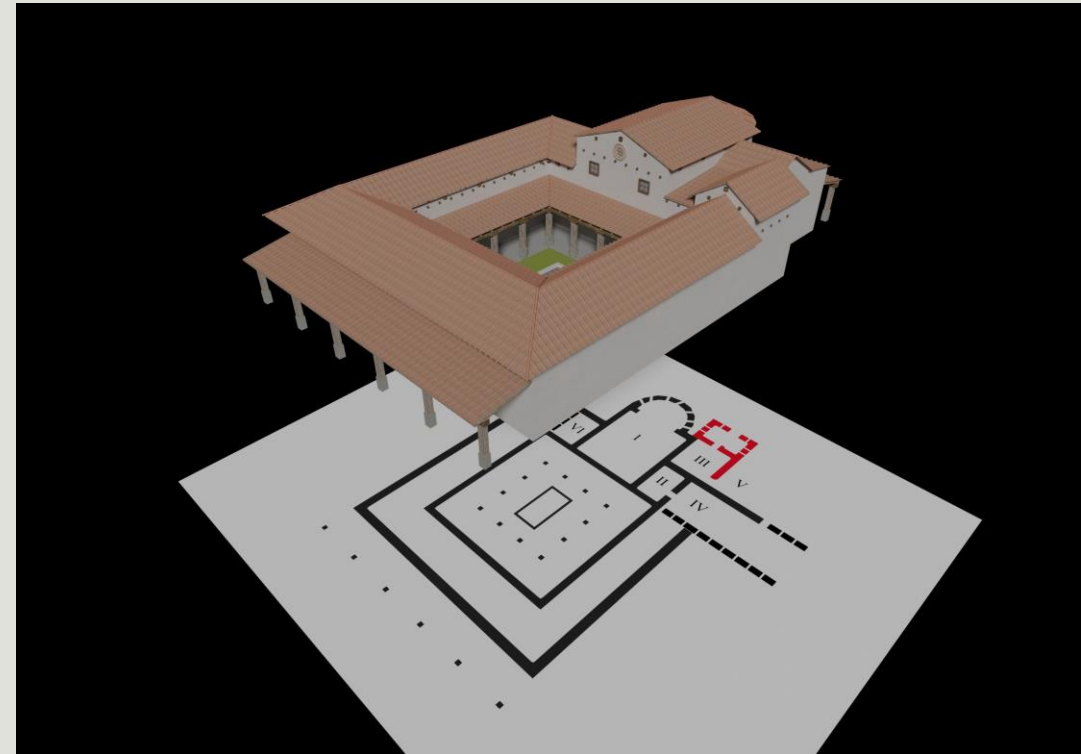
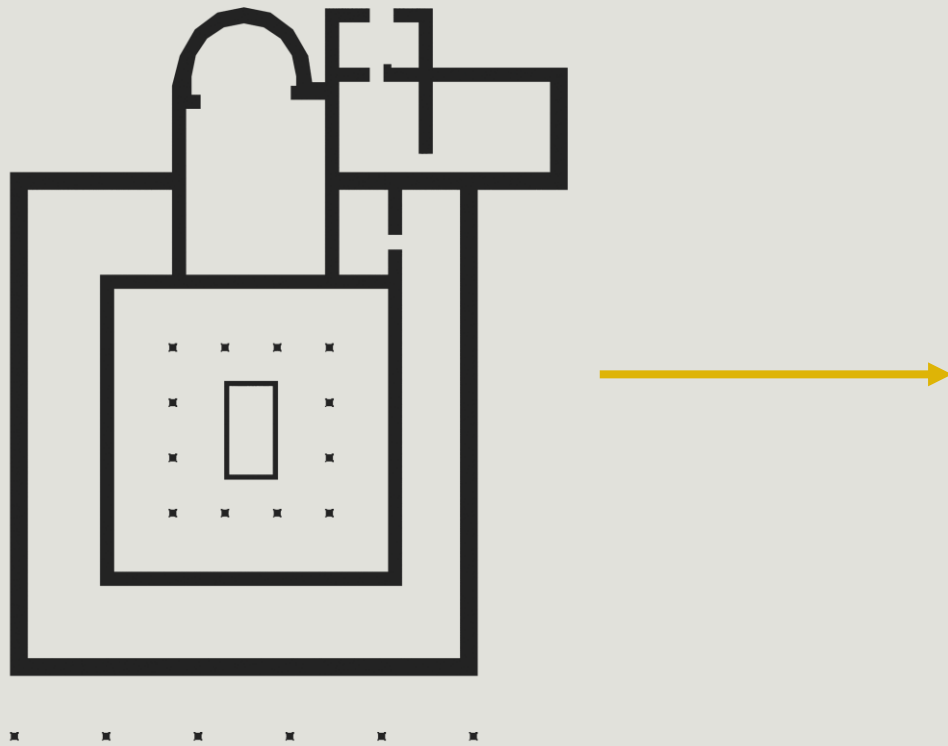
## Blender: ¿Qué podemos hacer con él?

- Edición y procesado de modelos 3D
- **Alineamiento de nubes de puntos**
- Visualización y presentación de modelos 3D
- **Reconstrucción de geometrías a partir de nubes de puntos**
- Escalado y orientación de modelos 3D
- Simplificado y refinado de geometrías
- Herramientas de medida





# Softwares de edición 3D



Reconstrucción virtual de la villa romana de Matabuey (Nava de la Asunción, Segovia)

# Softwares de edición 3D

---



*Reconstrucción virtual de la villa romana de Matabuey (Nava de la Asunción, Segovia)*

# Blender

Barra de herramientas superior

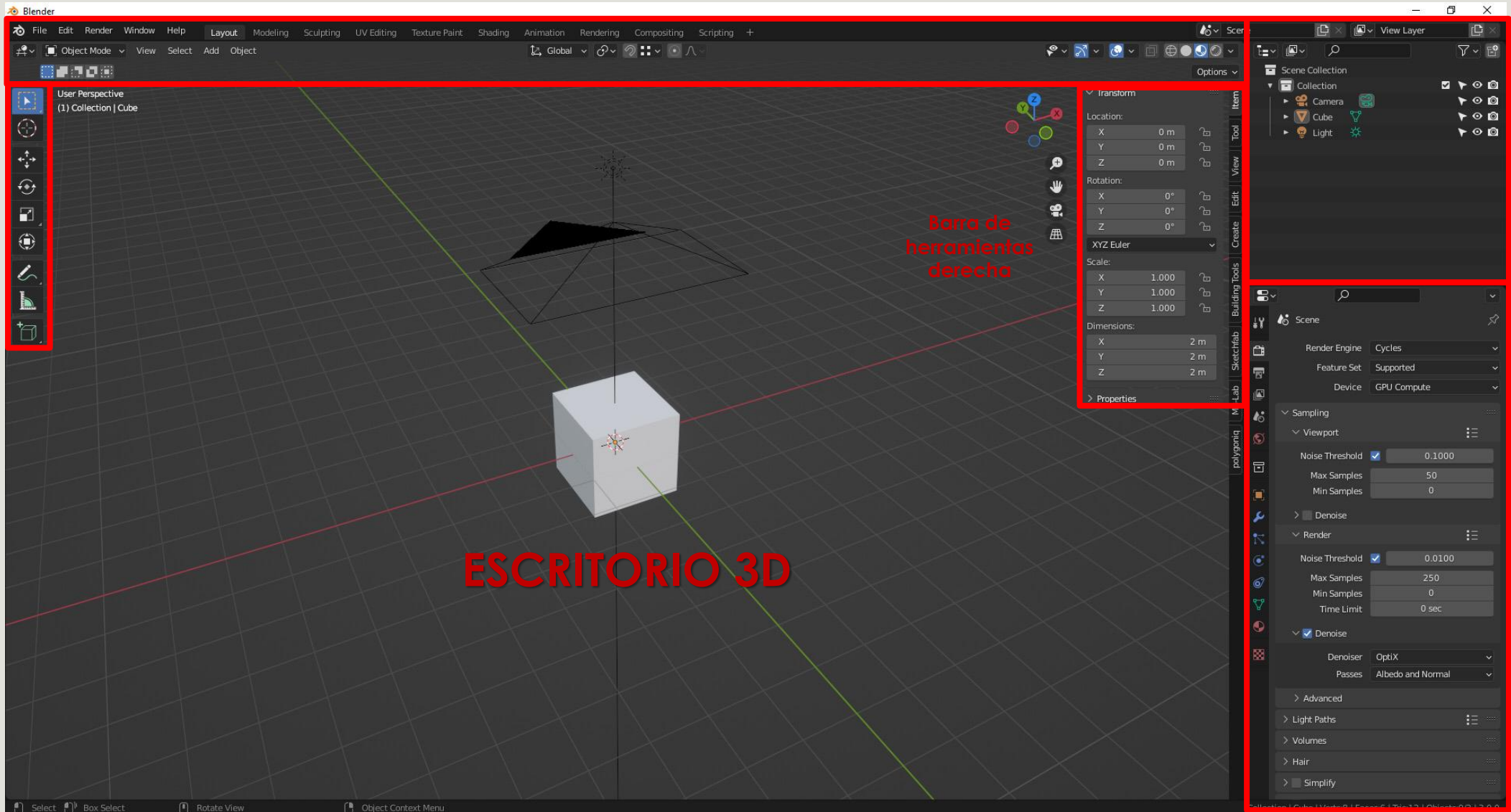
Barra de herramientas izquierda

Barra de herramientas derecha

Objetos de la escena

Herramientas de modificación, renderizado, etc.

ESCRITORIO 3D





# Blender

**Modos de visualización (de izda. a dcha.):**

- Vista wireframe (aristas y polígonos)
- Vista sólida (malla geométrica)
- Vista material (vista con textura y/o color)
- Vista renderizada (con iluminación)

Collection | Cube | Verts:8 | Faces:6 | Tris:12 | Objects:0/3 | 3.0.0



# Blender

## Controles básicos

Click izda. → Seleccionar

Click dcha. → Menú de opciones

Rueda ratón → Zoom

Click rueda ratón → Movimiento orbital

Shift + click rueda ratón → Travelling

G → Mover objeto

R → Rotar objeto

S → Escalar objeto

A → Seleccionar todo

Ctrl. + Z → Deshacer

Ctrl. + Shift + Z → Rehacer

Tab. → Modo Objeto / Modo Edición

## Controles vistas

Num. 5: Cambio perspectiva/ortogonal

Num. 1: Frente

Shift + Num. 1: Detrás

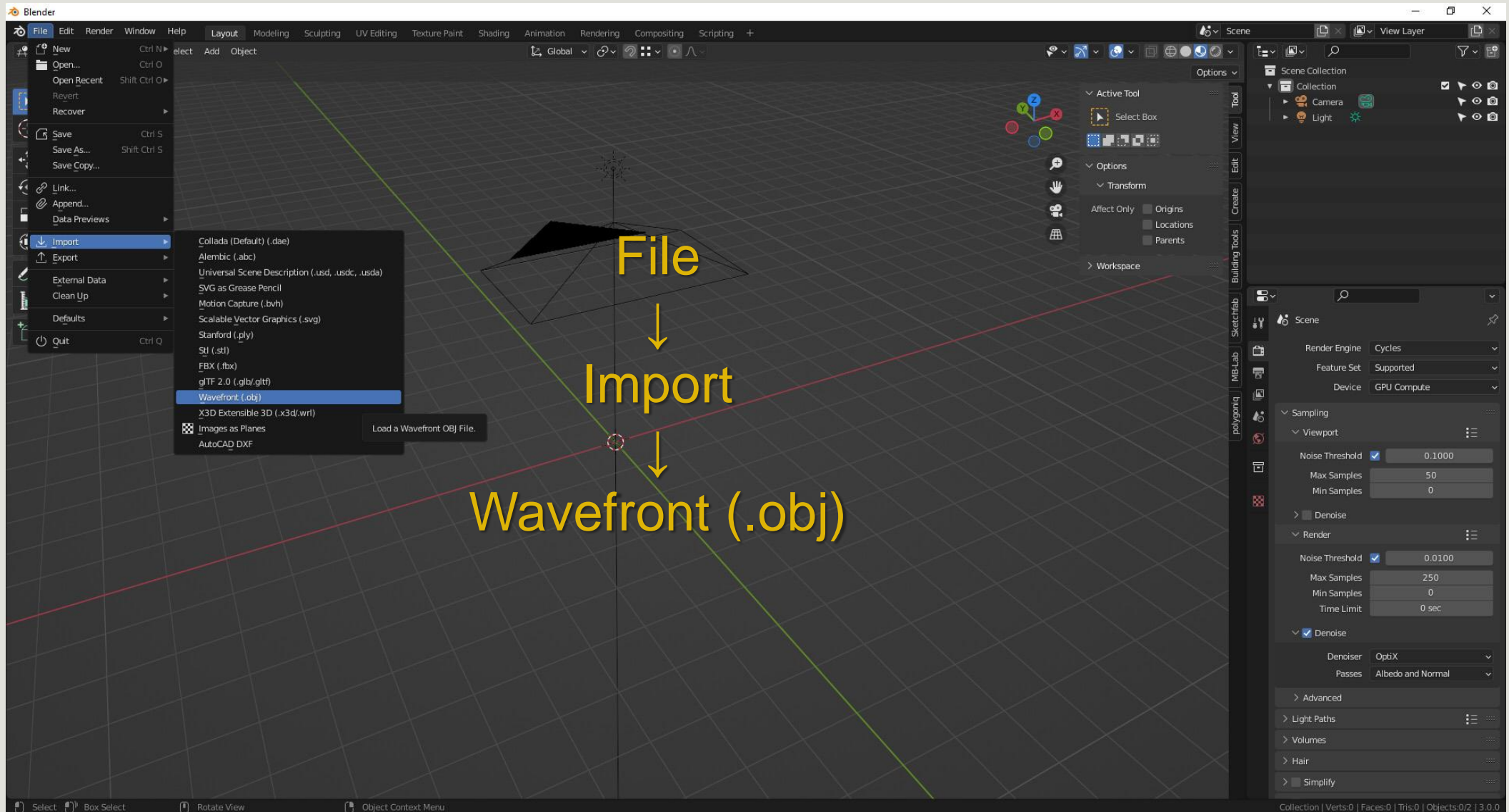
Num. 3: Izquierda

Shift + Num. 3: Derecha

Num. 7: Arriba

Shift + Num. 7: Abajo

# Blender: Importar modelo



# Blender: Centrar modelo

Click dcha.

↓

Set origin

↓

Origin to 3D Cursor

Object Context Menu

- Shade Smooth
- Shade Flat
- Convert To
- Set Origin**
- Copy Objects Ctrl C
- Paste Objects Ctrl V
- Duplicate Objects Shift D
- Duplicate Linked Alt D
- Rename Active Object... F2
- Mirror
- Snap
- Parent
- Move to Collection M
- Insert Keyframe... I
- Delete X
- Create UV Mesh
- Trim
- Wrap 0.00
- Wrap

Geometry to Origin

Origin to Geometry

**Origin to 3D Cursor**

Origin to Center of Mass (Center)

Origin to Center of Volume

Set the object's origin, by either moving the data, or set to center of data, or use 3D cursor: Origin to 3D Cursor

Move object origin to position of the 3D cursor

Transform

Location:

- X 0 m
- Y 0 m
- Z 0 m

Rotation:

- X 0°
- Y 0°
- Z 0°

XYZ Euler

Scale:

- X 1.000
- Y 1.000
- Z 1.000

Dimensions:

- X 5.21 m
- Y 0.612 m
- Z 5.75 m

Properties

Scene

Render Engine Cycles

Feature Set Supported

Device GPU Compute

Sampling

Viewport

- Noise Threshold  0.1000
- Max Samples 50
- Min Samples 0

Denoise

Render

- Noise Threshold  0.0100

Time Limit 0 sec

Denoise

- Denoiser OptiX
- Passes Albedo and Normal

Advanced

Light Paths

Volumes

Hair

Simplify

Collection | Escudo\_Villacalabuey | Verts:708,627 | Faces:1,414,109 | Tris:1,414,109 | Objects:1/3 | 3.0.0



# Blender: Centrar modelo

Click dcha.

Set origin

Geometry to Origin

Object Context Menu

- Shade Smooth
- Shade Flat
- Convert To
- Set Origin**
- Copy Objects Ctrl C
- Paste Objects Ctrl V
- Duplicate Objects Shift D
- Duplicate Linked Alt D
- Rename Active Object... F2
- Mirror
- Snap
- Parent
- Move to Collection M
- Insert Keyframe... I
- Delete X
- Create UV Mesh
- Trim
- Wrap 0.00

Transform

Location:

X	0 m
Y	0 m
Z	0 m

Rotation:

X	0°
Y	0°
Z	0°

XYZ Euler

Scale:

X	1.000
Y	1.000
Z	1.000

Dimensions:

X	5.21 m
Y	0.612 m
Z	5.75 m

Properties

Scene

Render Engine: Cycles

Feature Set: Supported

Device: GPU Compute

Sampling

Viewport

Noise Threshold: 0.1000

Max Samples: 50

Min Samples: 0

Denoise

Max Samples: 250

Min Samples: 0

Time Limit: 0 sec

Denoise

Denoiser: OptiX

Passes: Albedo and Normal

Advanced

Light Paths

Volumes

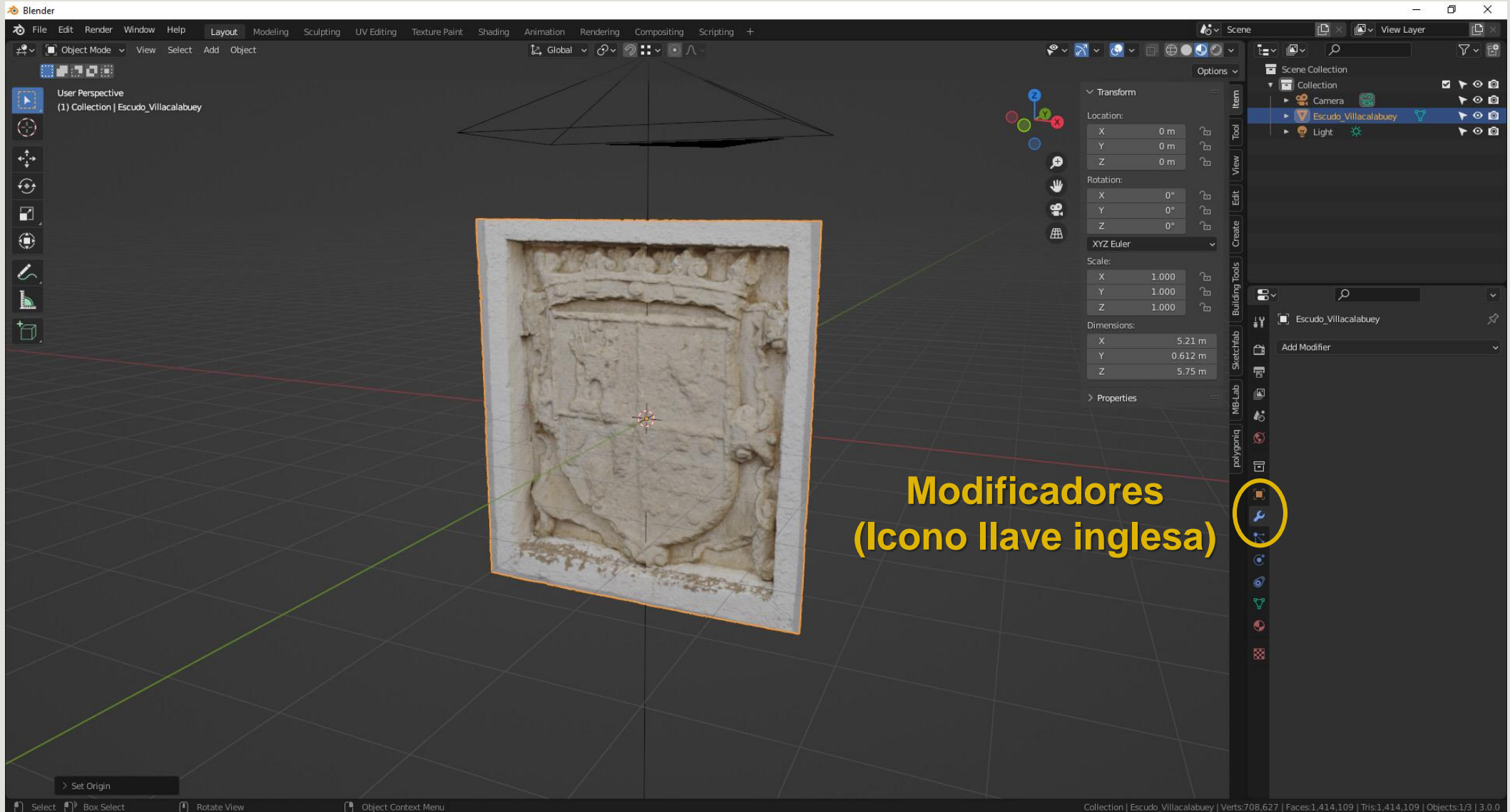
Hair

Simplify

Collection | Escudo\_Villacalabuey | Verts:708,627 | Faces:1,414,109 | Tris:1,414,109 | Objects:1/3 | 3.0.0



# Blender: Decimado



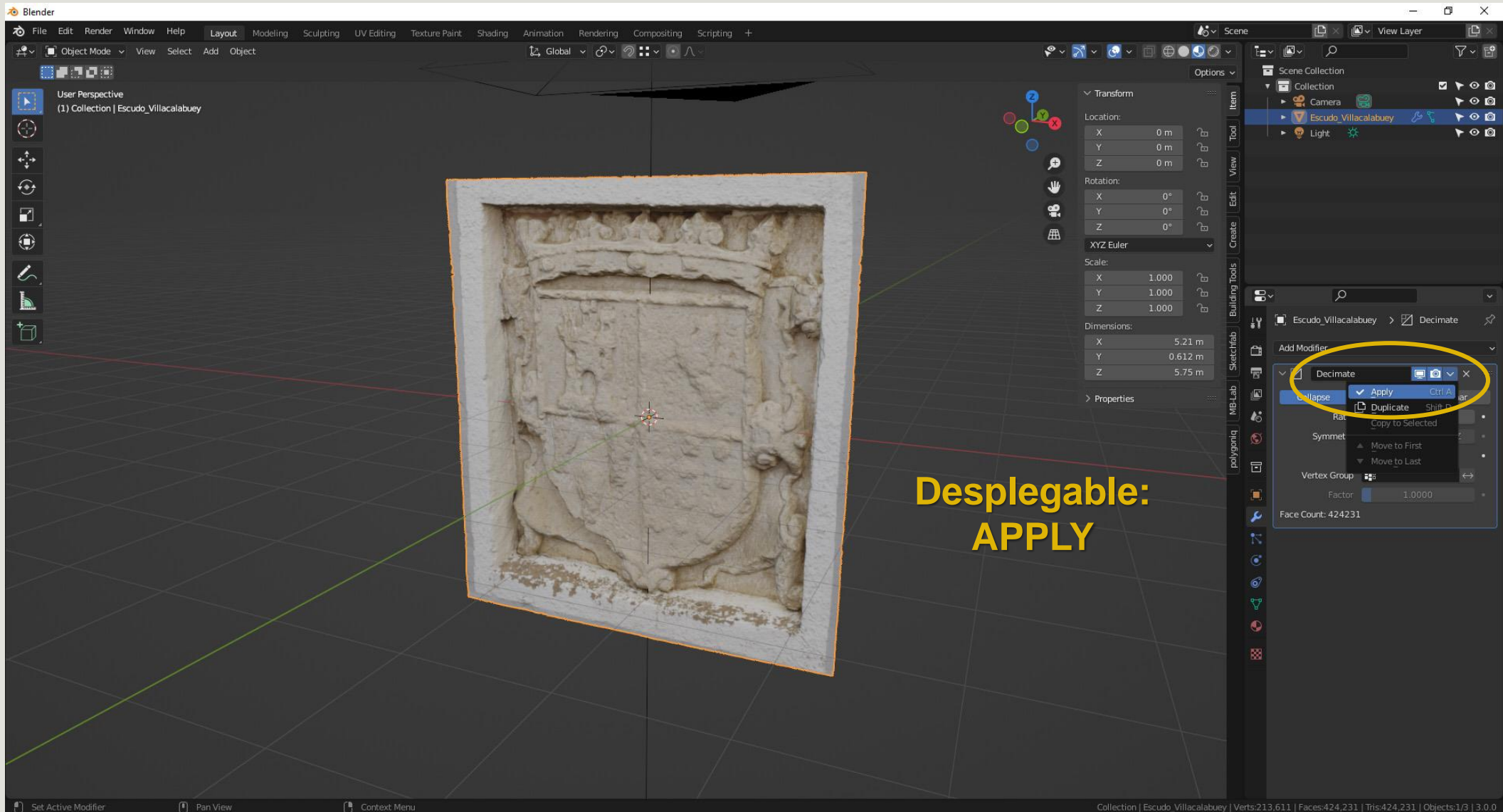
# Blender: Decimado

The screenshot displays the Blender 2.80 interface. In the center, a 3D view shows a textured stone relief object. A yellow box highlights the 'Decimate' modifier settings in the Properties panel, showing a Ratio of 0.3000 and a Face Count of 424231. To the right, the 'Add Modifier' menu is open, with 'Decimate' highlighted in a yellow circle. The status bar at the bottom indicates the object has 708,627 vertices, 1,414,109 faces, and 1,414,109 tris.

**Ratio: % de disminución de polígonos**

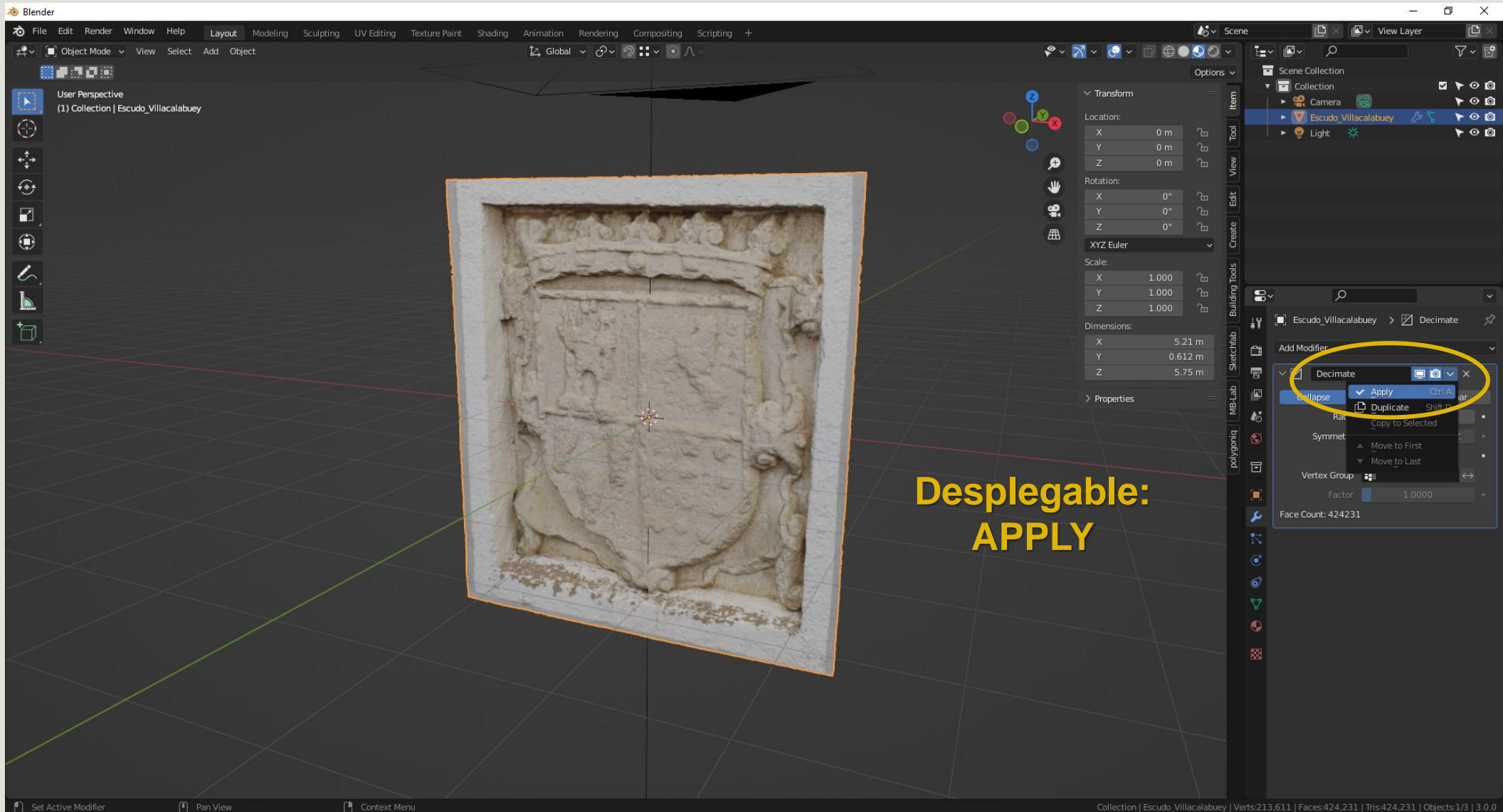
**Add Modifier: Decimate**

# Blender: Decimado





# Blender: Decimado





# Blender: Decimado



Modelo sin decimar



Modelo decimado



# Blender: Decimado



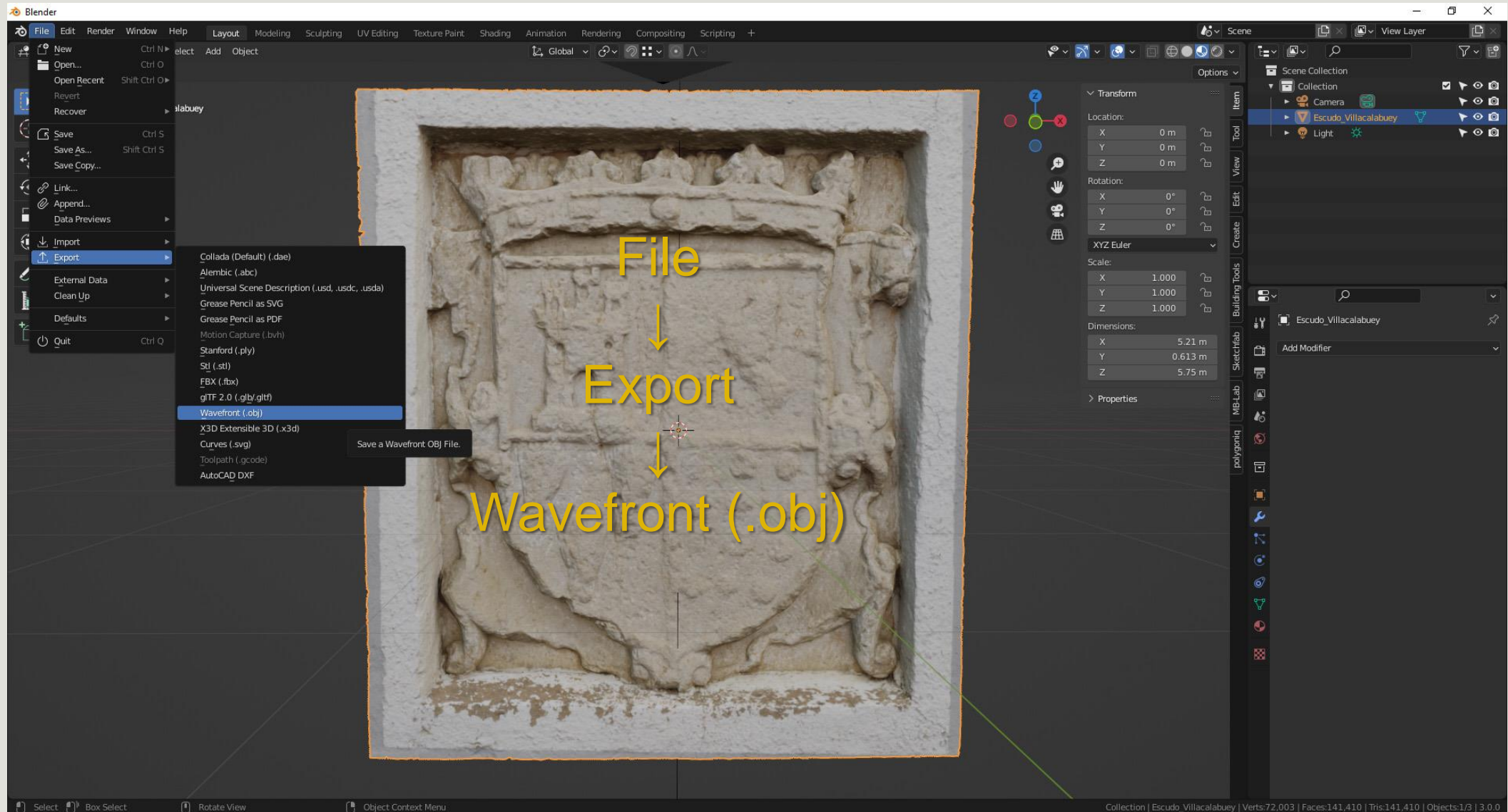
Modelo sin decimar



Modelo decimado



# Blender: Exportar modelo



# Blender: Exportar modelo

The image shows the Blender 2.80 interface with the 'Export > OBJ' dialog box open. The dialog box has the following settings:

- Operator Presets: + -
- Include:  Selection Only
- Objects as:  Obj Objects,  OBJ Groups,  Material Groups
- Limit to: 0.000
- Animation:  Animation, 5.21 m
- Scale: 1.00
- Path Mode: Auto
- Forward: -Z Forward
- Up: Y Up
- Geometry: > Geometry

A yellow text overlay in the center of the dialog box reads: **¡OJO!**  
Selection only para objetos individuales

The background shows a 3D model of a dental arch in Object Mode. The 'Blender File View' window is open, showing the file system. The 'Scene' panel on the right shows the current scene settings. The status bar at the bottom indicates: Collection | Escudo\_Villacalabuey | Verts:72,003 | Faces:141,410 | Tris:141,410 | Objects:1/3 | 3.0.0



