

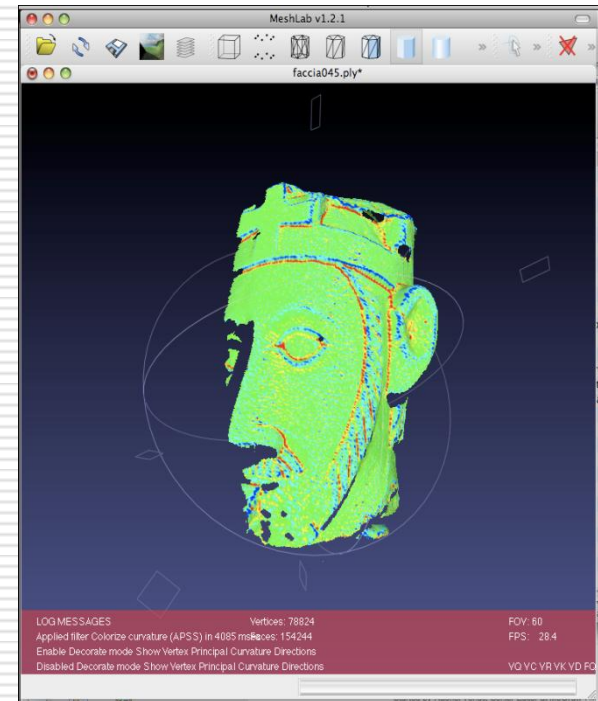
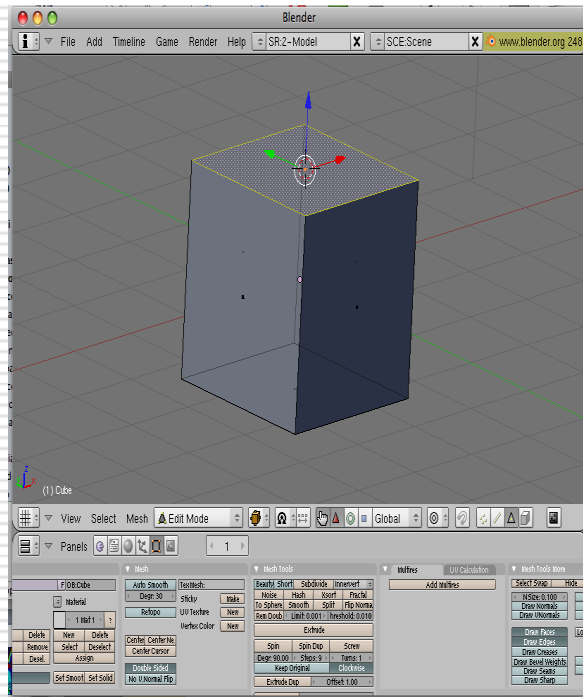


# **Grafica 3D per i beni culturali: MeshLab intro and basics**

Lezione 7: 22 Marzo 2012

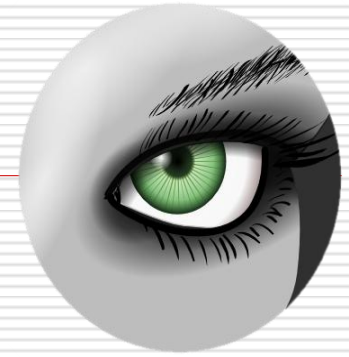
# Editing vs Processing

- ❑ Manual modifications
- ❑ User authors the results
- ❑ Semi-automatic processing
- ❑ User supervises a process



# MeshLab

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- ❑ Developed at ISTI-CNR
  - ❑ 3D-COFORM Project
  - ❑ Targeted to supervised Mesh Processing
    - 3D scanning tools
    - Hundred of filters
    - With some simple editing functionalities
      - ❑ Painting
      - ❑ Selecting
-

# MeshLab: Where?!?

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- MeshLab website
    - <http://meshlab.sourceforge.net/>
  - MeshLab SVN repository
    - <https://meshlab.svn.sourceforge.net/svnroot/meshlab/trunk/meshlab>
  - MeshLab download page
    - <http://sourceforge.net/projects/meshlab/files/>
  - MeshLab online help (devoted to programmers)
    - [http://meshlab.sourceforge.net/wiki/index.php/MeshLab\\_Documentation](http://meshlab.sourceforge.net/wiki/index.php/MeshLab_Documentation)
  - MeshLab blog
    - <http://meshlabstuff.blogspot.com/>
  - MeshLab forum (Help)
    - <http://sourceforge.net/projects/meshlab/forums/forum/499533>
  - MeshLab's "fathers"
    - <http://vcg.isti.cnr.it/joomla/index.php>
-

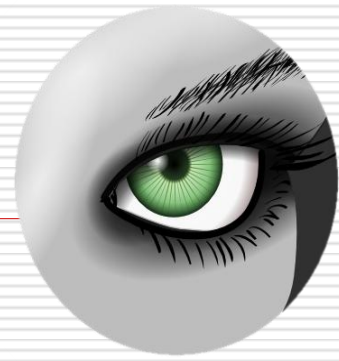
# MeshLab Philosophy

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- GPL license
    - Free download
    - You can read MeshLab code
    - You can freely change it
  - New developers are welcome!
    - If they don't touch my code 😊
  - Effective Plugin Architecture
    - MeshLab **is not** monolithic
    - Flexibility
    - Increase code production
    - Decrease compilation time
    - You can assemble your own MeshLab release
-

# MeshLab Basics

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- MeshLab's Mesh**
  - Files Manipulation & Formats**
  - TrackBall & Lighting manipulation**
  - Layers Management**
  - Selection Mode**
  - Render Mode & Shading**
  - Filters and Filter Prerequisite**
  - Snapshot**
-

# MeshLab's Mesh



# MeshLab's Vertex Attributes

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- ❑ Position - 3d coords
- ❑ Normal - 3d vector
- ❑ Color - rgba color
- ❑ Texture Coordinates - 2d coords
- ❑ Quality - number
- ❑ Some other stuff (flags, radius)

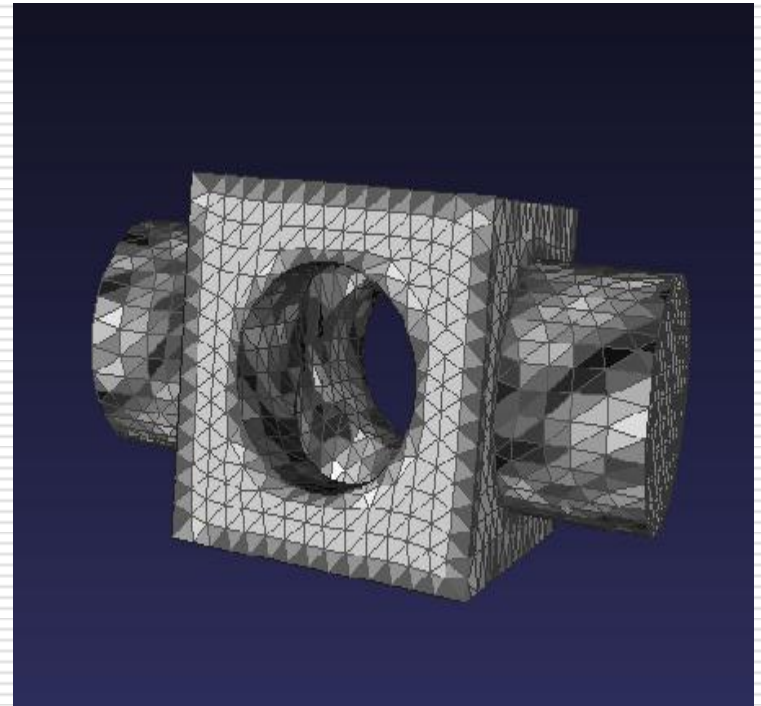




# MeshLab's Face Attributes

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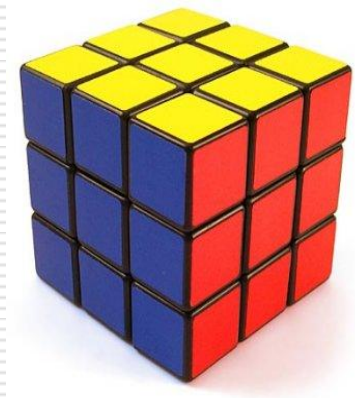
- ❑ Color – rgba color
- ❑ Normal – 3d vector
- ❑ Quality – number
- ❑ Vertices' indices – 3 indices



# Wedge

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- More than edges in MeshLab we focus in attributes for wedge
- What is wedge?!?
  - A single vertex is part of more than one face
  - A vertex's attribute value could be different depending on the face



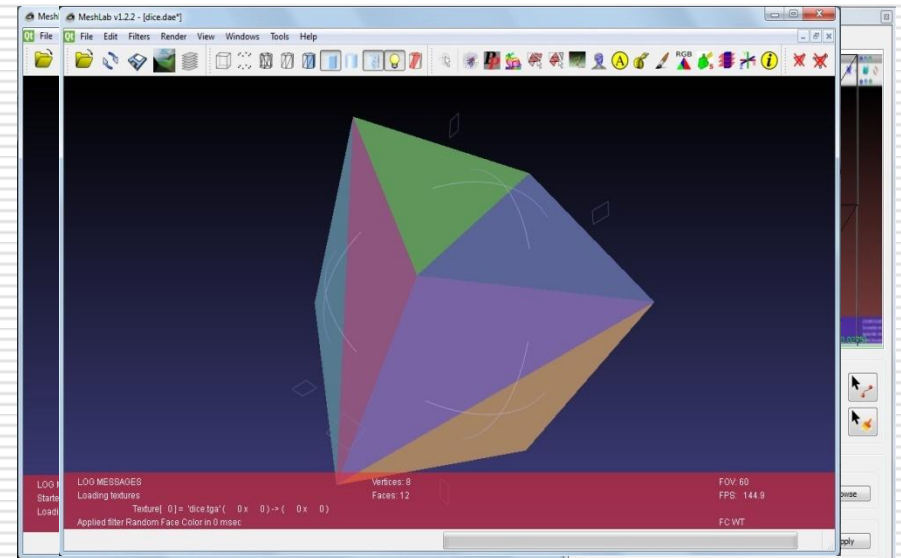
# MeshLab's Wedge

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□ Texture Coords – 2d coords

□ Color – rgba color

□ Normal – 3d vector



# Files Manipulation & Formats



# Supported File Formats

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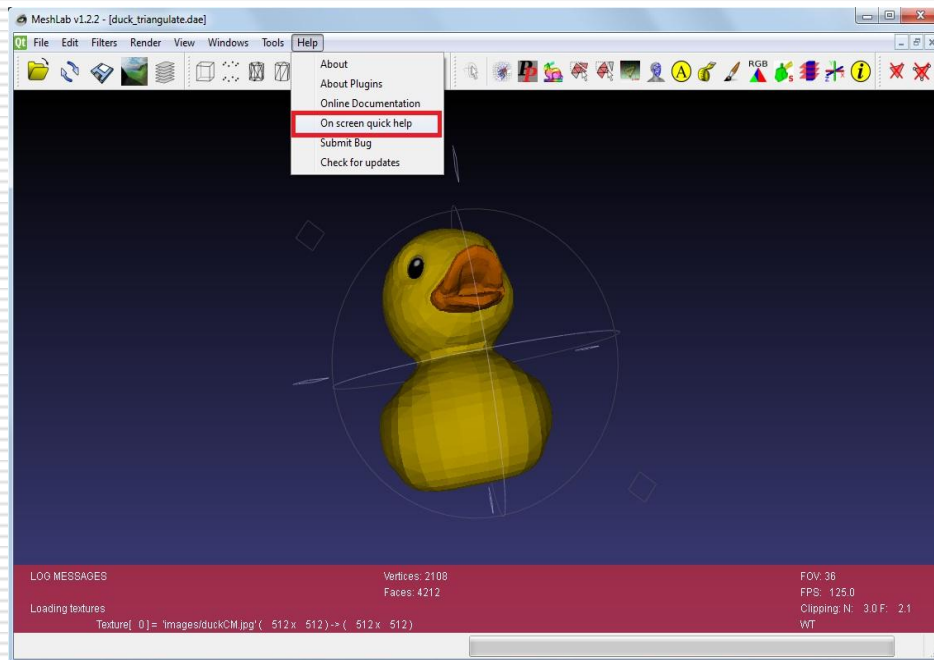
- Many Input/Output formats supported
    - **Import:**
      - PLY, STL, OFF, OBJ, 3DS, COLLADA, PTX, V3D, PTS, APTS, XYZ, GTS, PDB, TRI, ASC, X3D, X3DV, WRL, ALN...
    - **Export:**
      - PLY, STL, OFF, OBJ, 3DS, COLLADA, VRML, DXF, U3D, GTS, IDTF, X3D...
  - Raster models! JPG, PNG, XPM
  - Directly open and process the models reconstructed by the Epoch 3D Web Service (V3D) and Photosynth!
  - New MeshLab project file!!!!!!!
-

# TrackBall & Lighting manipulation



# First of all...

- Help->On screen quick help

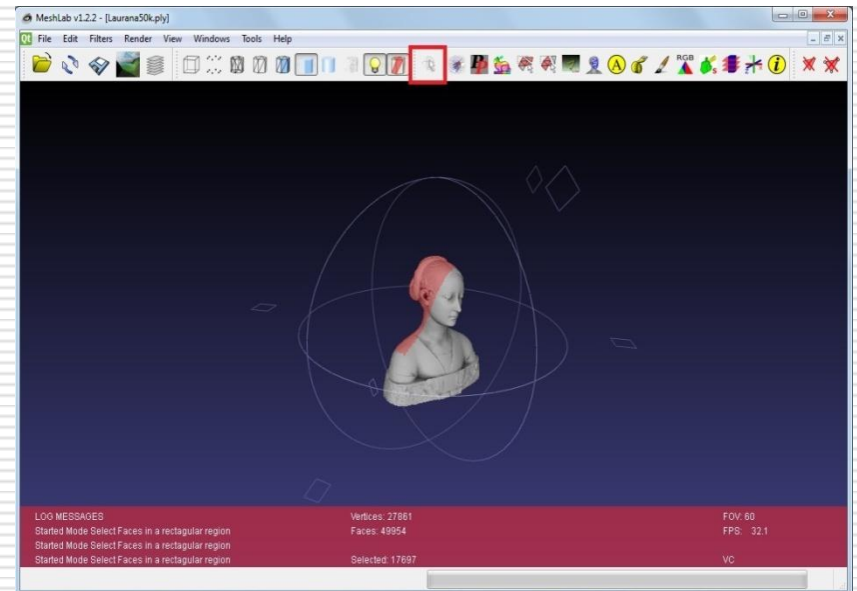
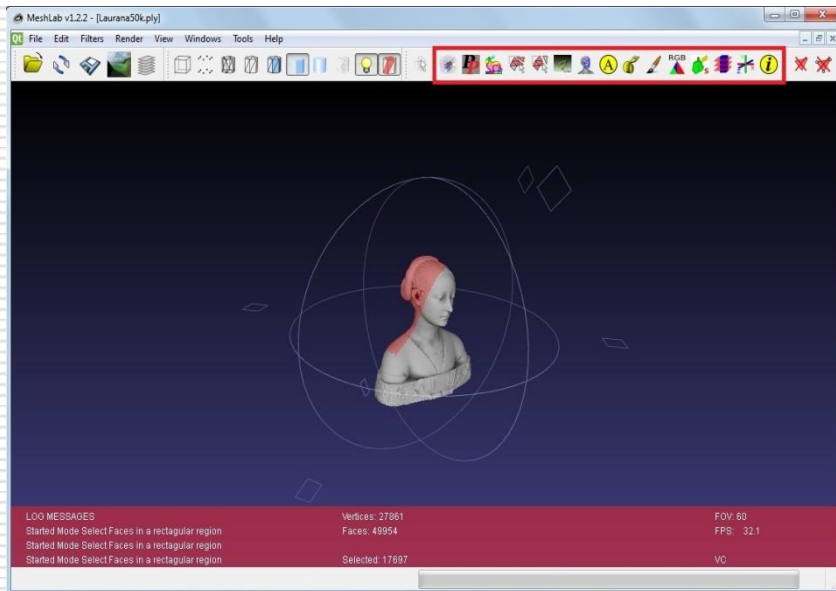


| MeshLab Quick Help |                            |
|--------------------|----------------------------|
| Drag:              | Rotate                     |
| Ctrl-Drag:         | Pan                        |
| Shift-Drag:        | Zoom                       |
| Alt-Drag:          | Z-Panning                  |
| Ctrl-Shift-Drag:   | Rotate light               |
| Wheel:             | Zoom                       |
| Shift-Wheel:       | Change perspective         |
| Ctrl-Wheel:        | Move far clipping plane    |
| Ctrl-Shift-Wheel:  | Move near clipping plane   |
| Double Click:      | Center on mouse            |
| F1:                | Toggle this help           |
| Alt+enter:         | Enter/Exit fullscreen mode |

# Trackball Mode

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- ❑ Trackball mode is the starting interaction mode
- ❑ Clicking on an icon of edit toolbar switch to edit mode
- ❑ to turn back to Trackball mode
  - Click again on the same icon
  - Click on Trackball mode icon



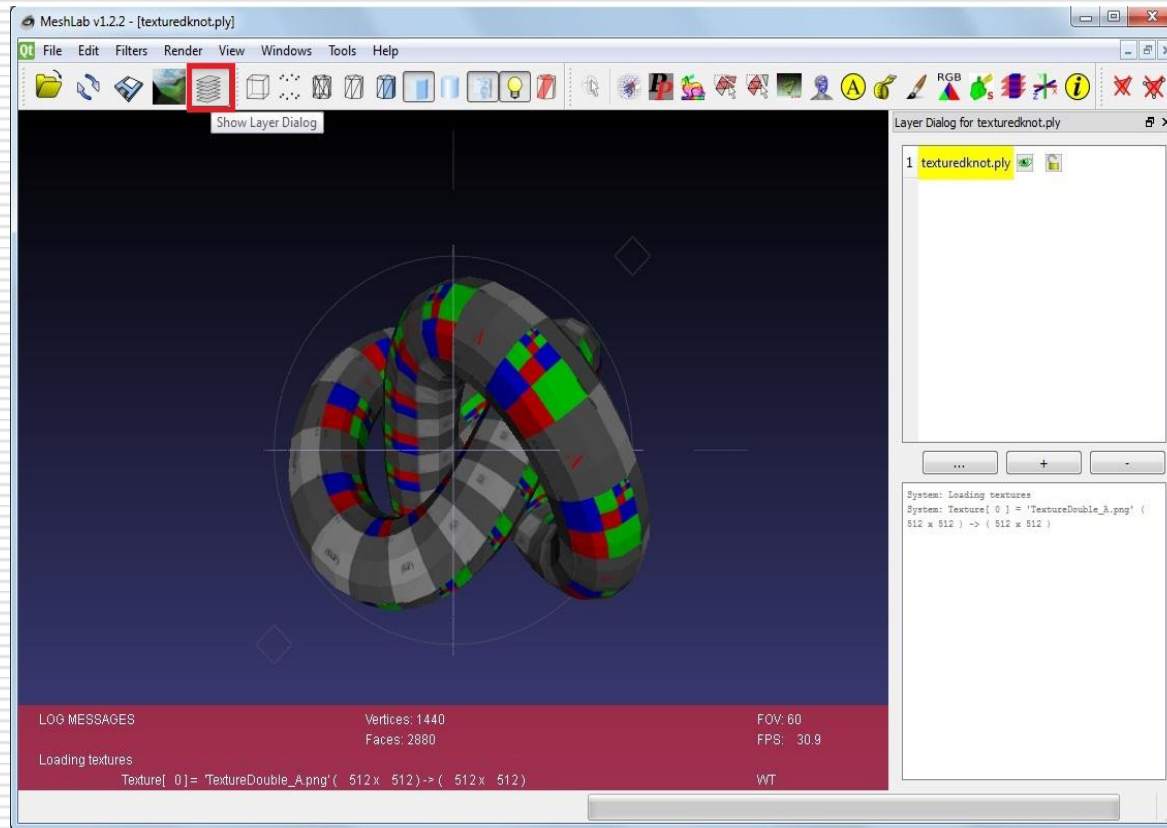


# Layers Management



# Layer

## □ Layer Dialog icon in toolbar



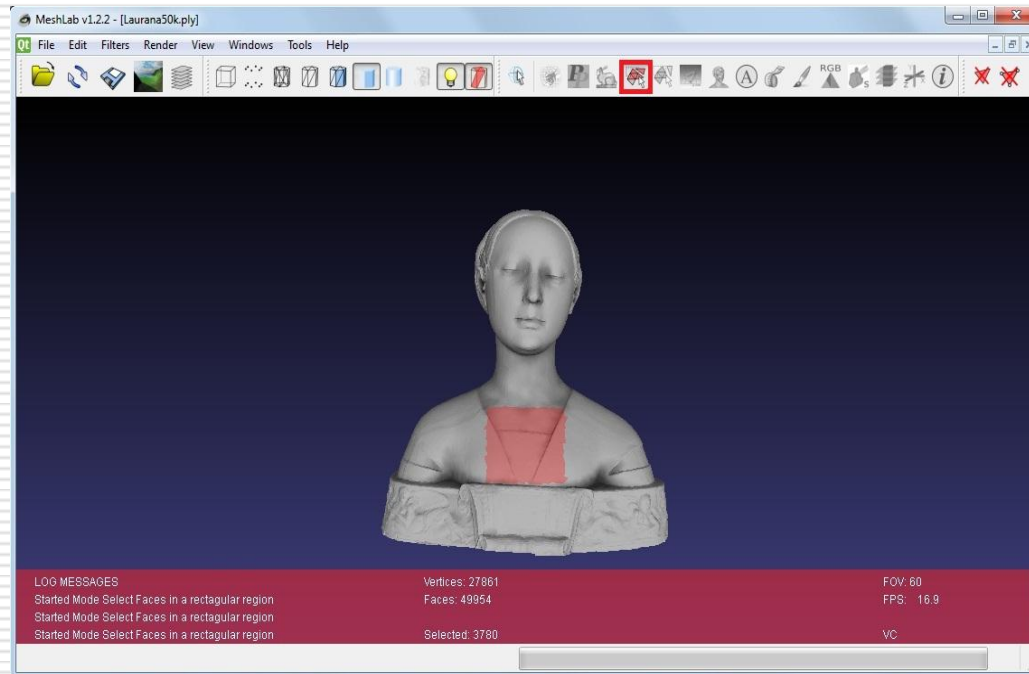
# Selection Mode



# Selection (1)

---

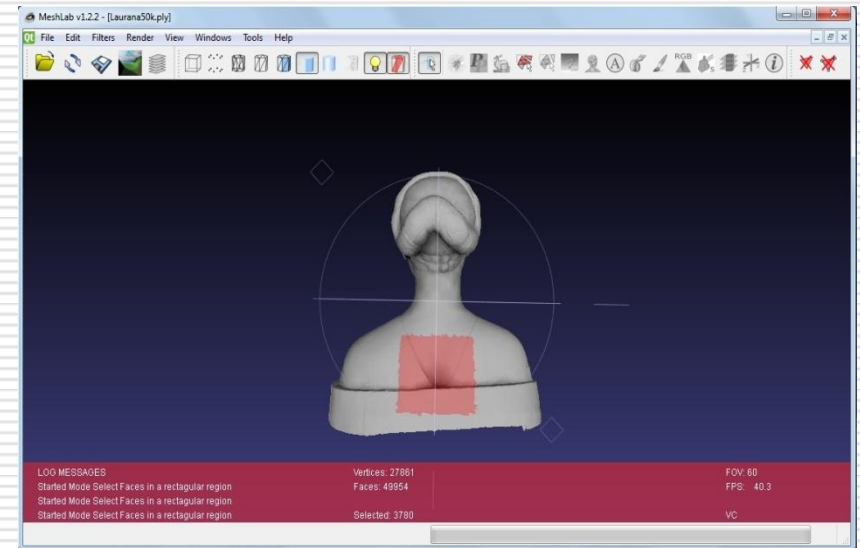
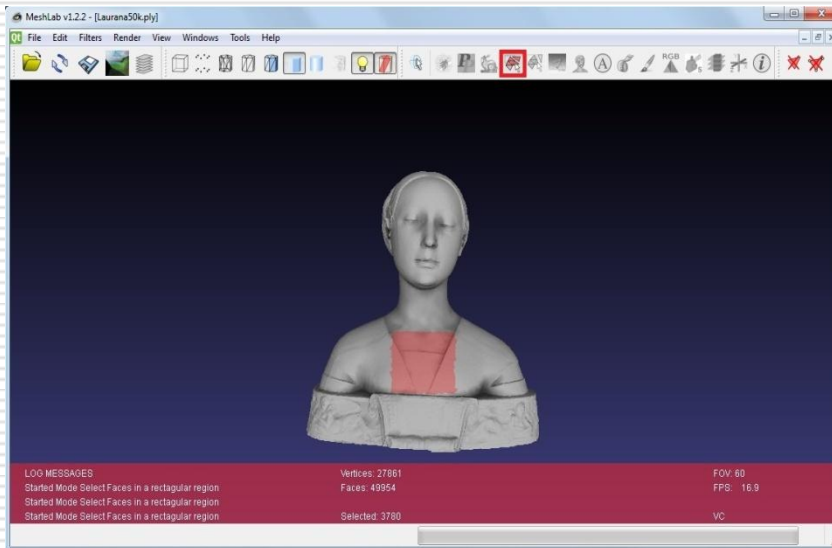
- Selection is a key operation
  - remove useless/"wrong" geometry



# Selection (2)

---

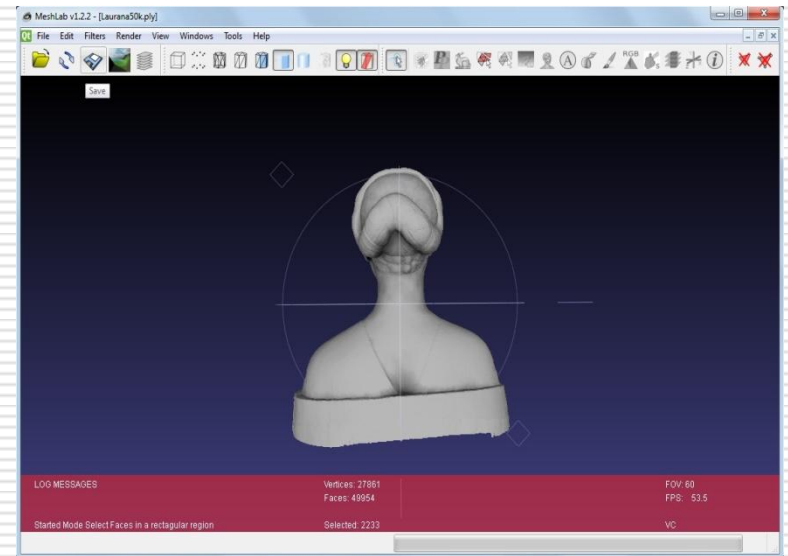
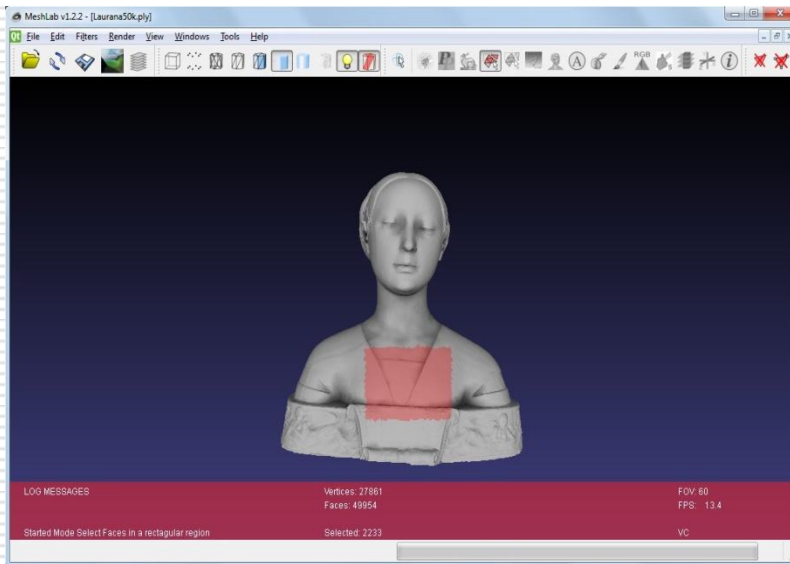
- ❑ In MeshLab many kind of selection!
- ❑ The base one is double sides selection
  - Selecting a front area means selecting also back one!



# Selection (3)

---

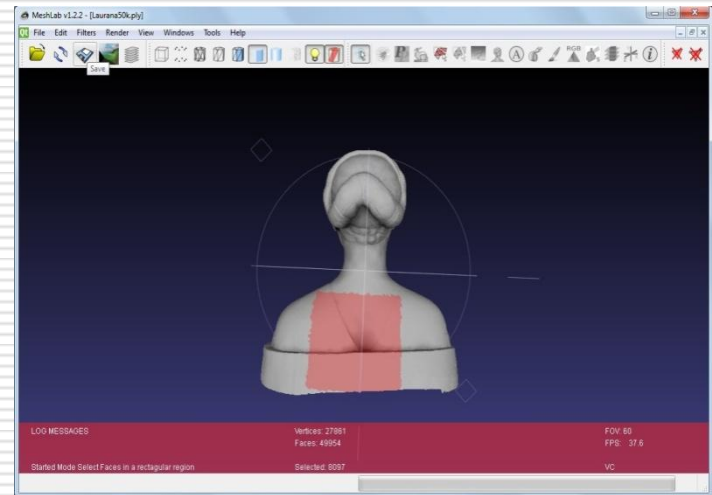
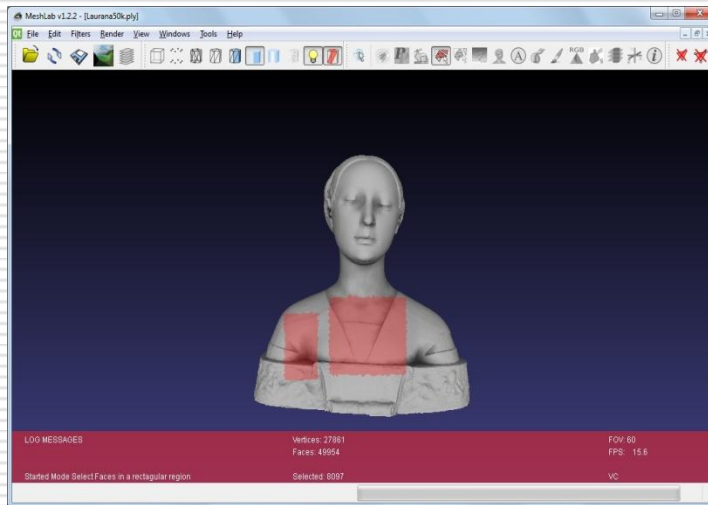
- Select only front area
  - Switch on Selection Mode
  - Alt + drag (eye icon)



# Selection (4)

---

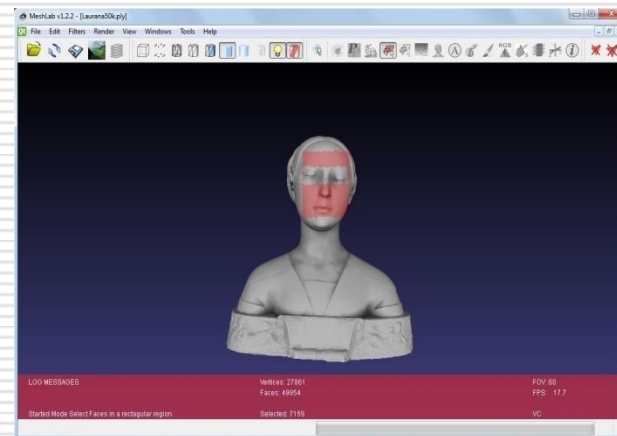
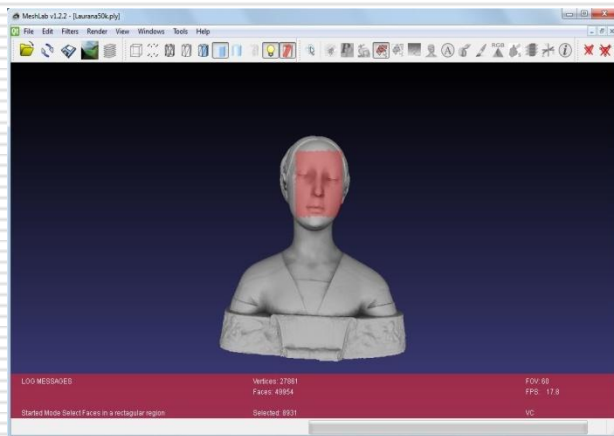
- Add a new selected area to a previous one
  - Switch on Selection Mode
  - Ctrl + drag (“+” icon)
  - Could be used in conjunction with “only front selection” (eye and “+” icon)



# Selection (5)

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- ❑ Remove a sub area from a selection
  - Switch on Selection Mode
  - Select an area
  - Shift + drag (“-” icon)
  - Could be used in conjunction with “only front selection” (eye and “+” icon)





# Selection (6)

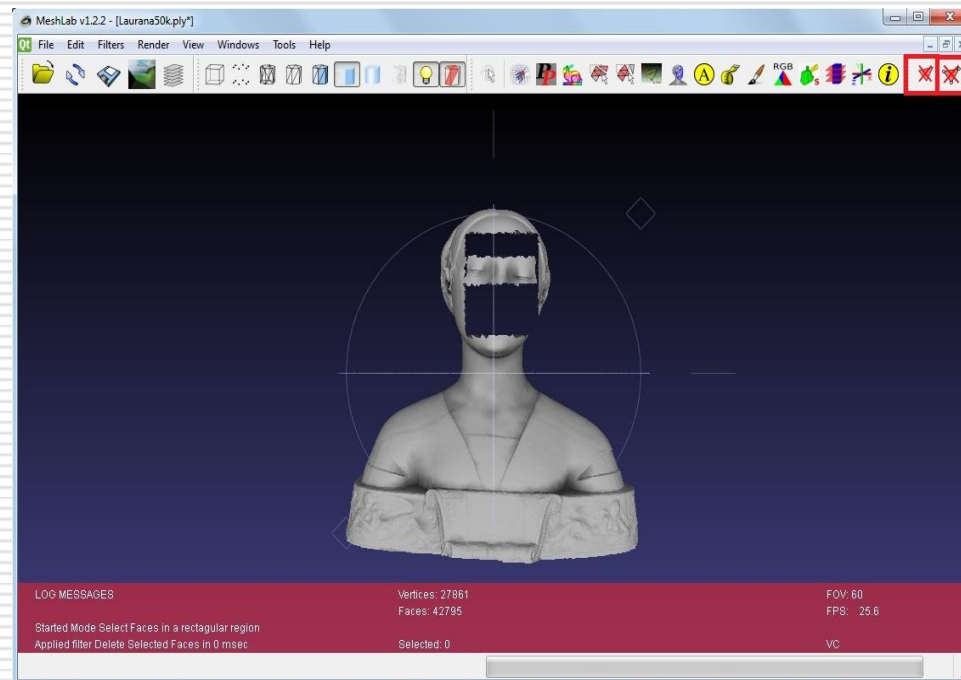
---

- ...and many others
    - Small pieces
    - Quality
    - Erosion
    - Expansion
    - Connected Component
  - We will discover them during the course...
-

# Delete Faces and/or Vertices

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-  Remove only faces (but not unref vertices)
-  Remove faces and vertices

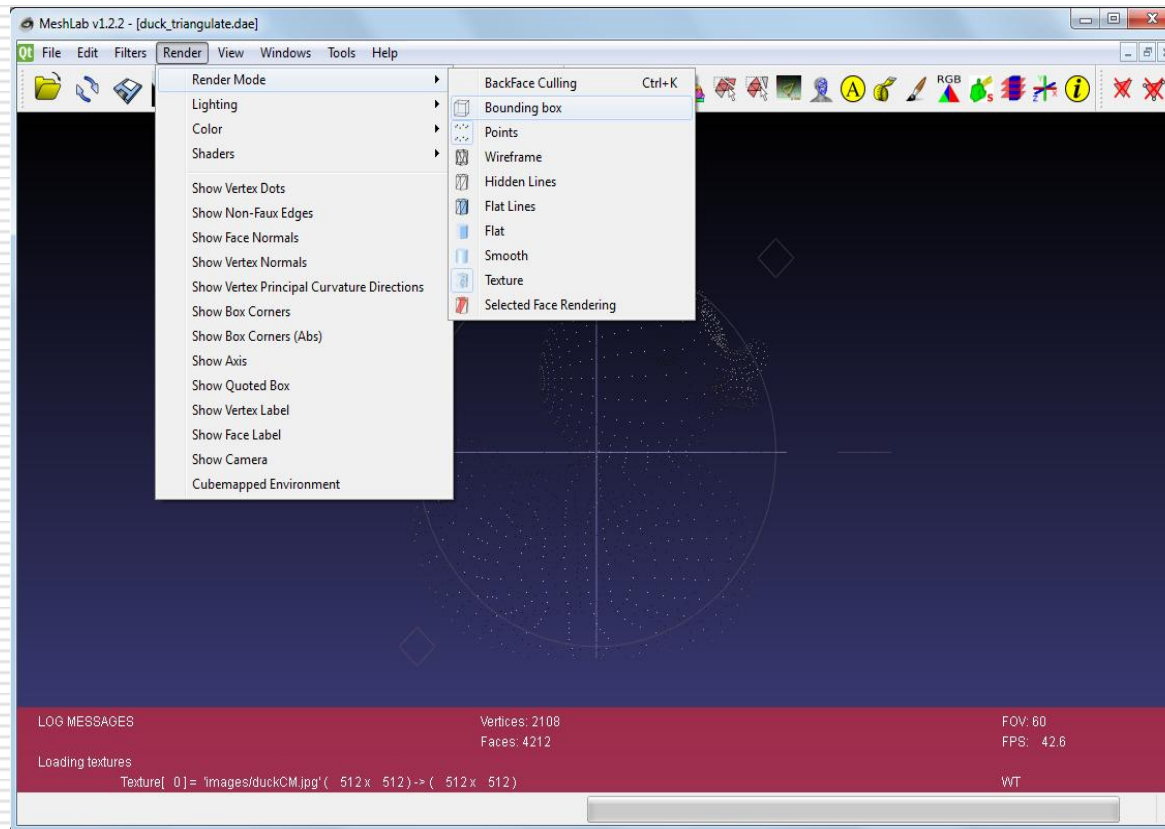


# Render Mode & Shading



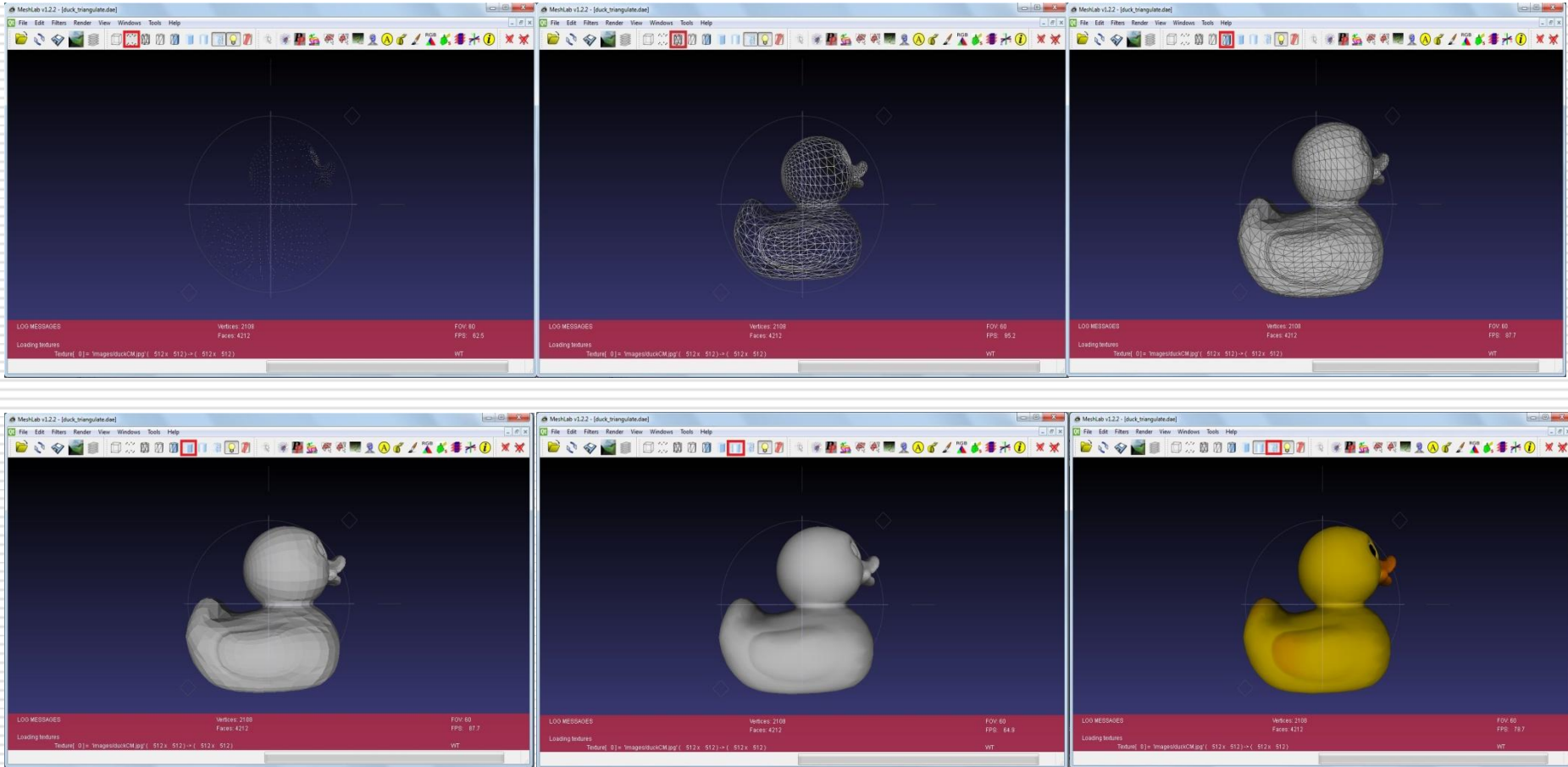
# Render Mode

## □ Render->Render Mode



# Basic Rendering Mode

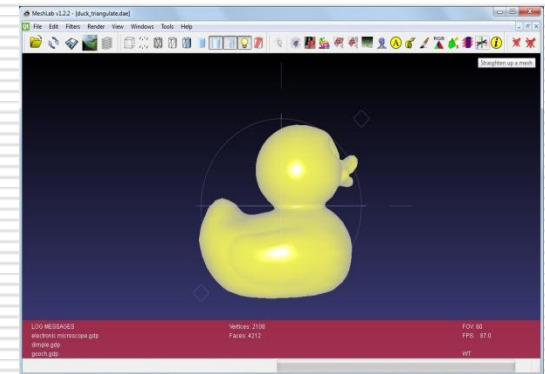
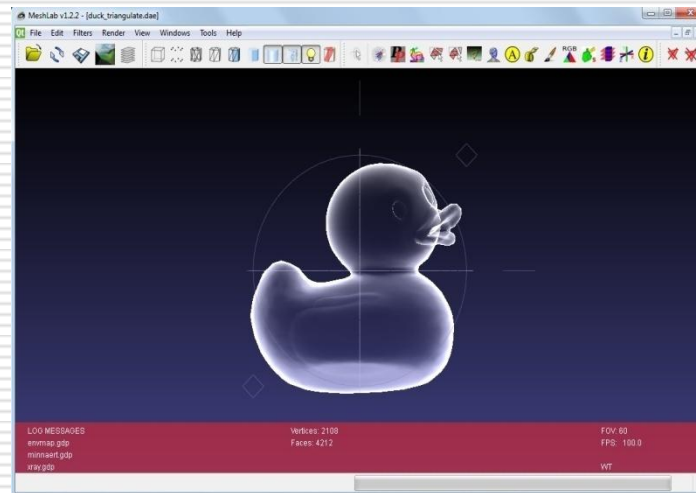
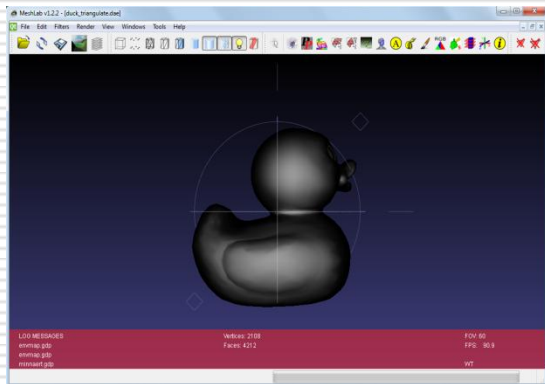
---



# Shading Mode

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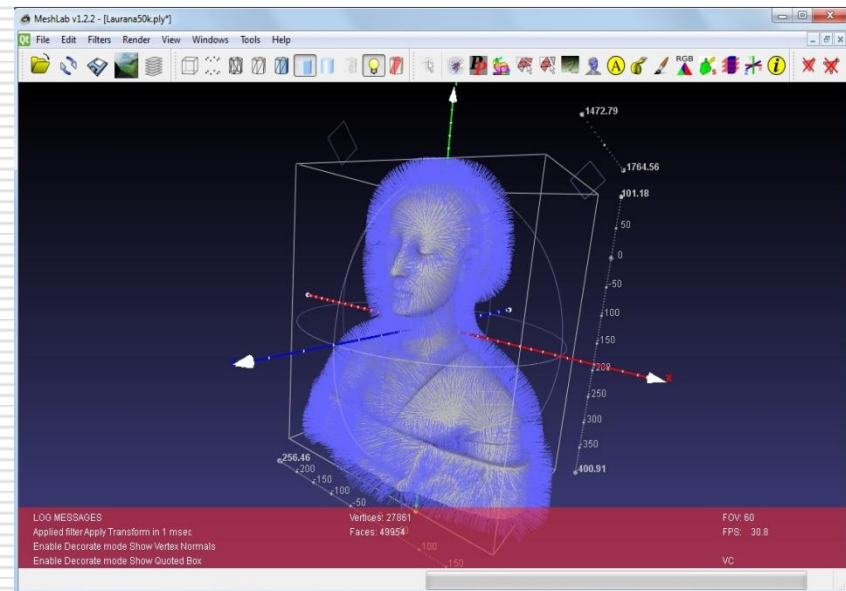
- ❑ Shading Model == a computational model to simulate how light interact with a 3d Object
- ❑ Render->Shader



# Decorate Mode

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- Render submenu
- Adding visual info of the Mesh
  - Per face/vertex normals
  - Mesh's Bounding box (quoted)
  - Principal axis



# Filters and Filters' Prerequisite





# Filters

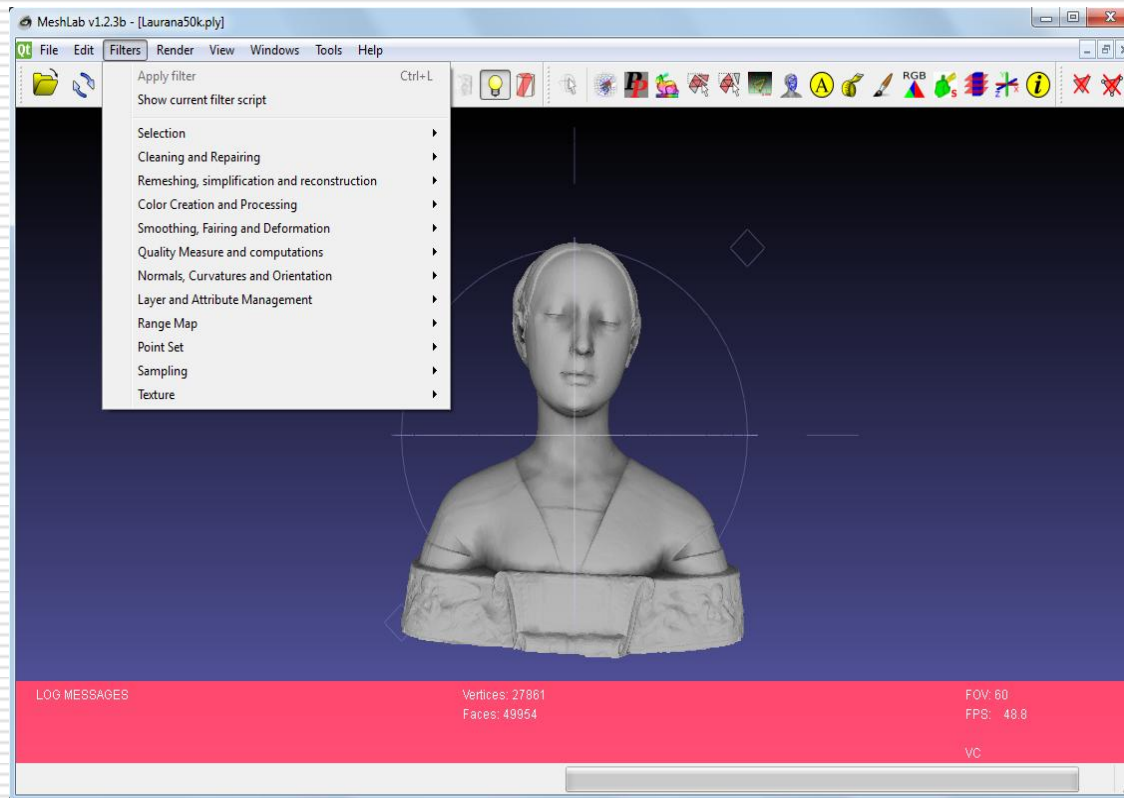
---

- What is a Filter?!?
    - Automatic algorithm that can be applied to a mesh
  - In MeshLab a filter changes the state of a mesh
    - Vertex position
    - Color
    - Quality
    - Normal
    - Triangulation
    - etc
  - > 100 different filters in MeshLab
-

# MeshLab's Filters

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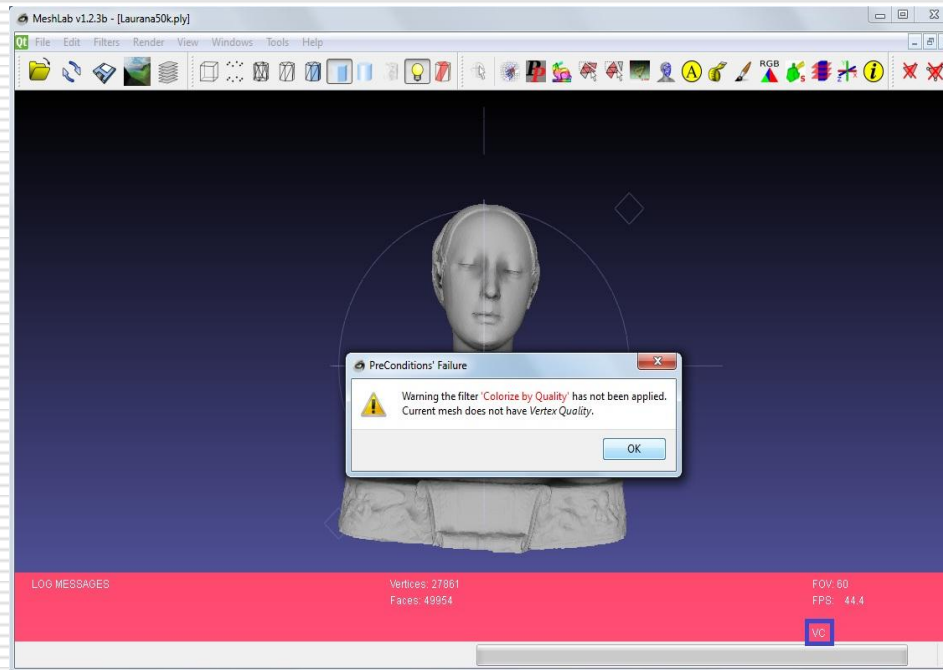
## □ Filters Menu



# Filter Prerequisites

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- Some filters need that some mesh's attributes have been defined
  - colorize a mesh by quality implies VQ presence

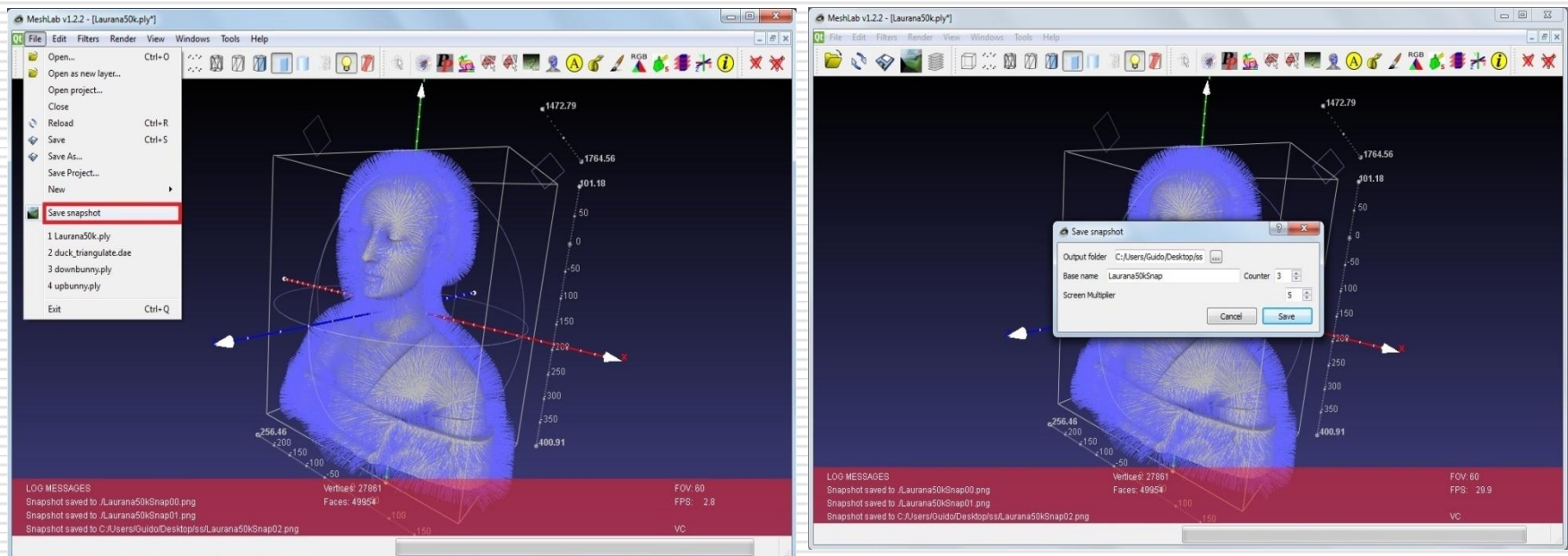


# SnapShots



# SnapShots

- ❑ MeshLab exports his rendering context in high resolution
  - Could be useful for documentation
- ❑ Png image format



# Next in line...

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Next lesson:

- 3D Scanning in MeshLab

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VCG website: <http://vcg.isti.cnr.it>

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