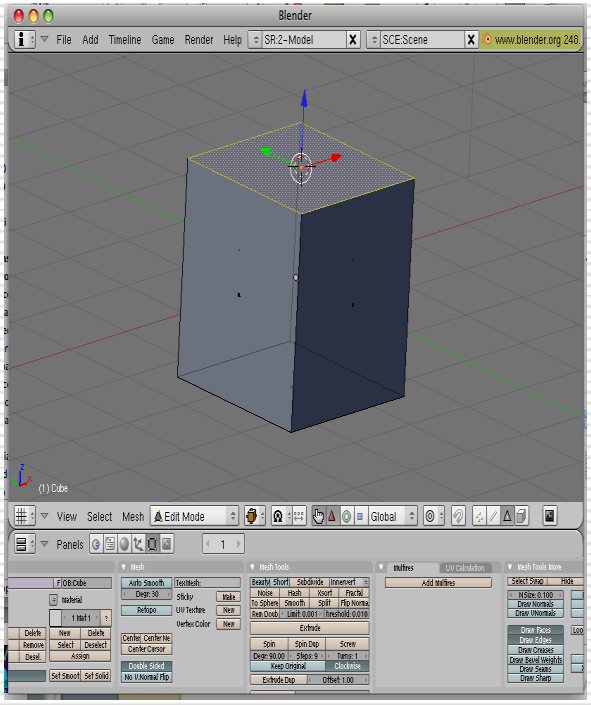
Grafica 3D per i beni culturali: MeshLab intro and basics

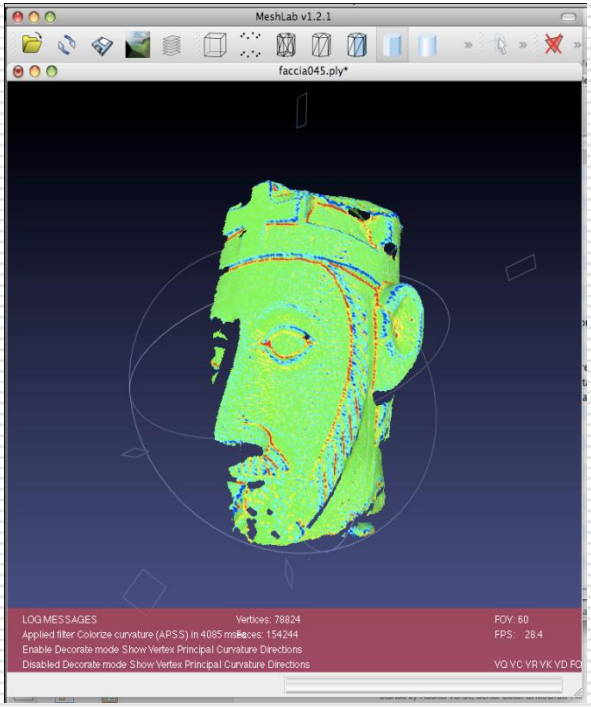
17 Marzo 2016

Editing vs Processing

- Manual modifications
- User authors the results

- Semi-automatic processing
- User supervises a process





MeshLab

- 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?!?

- 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
- 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: Where?!?

Written documentation is for losers.

The most updated and used source of documentation for MeshLab is currently the beloved Mister P. MeshLab tutorial channel

http://www.youtube.com/user/MrPMeshLabTutorials

MeshLab Philosophy

- 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

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

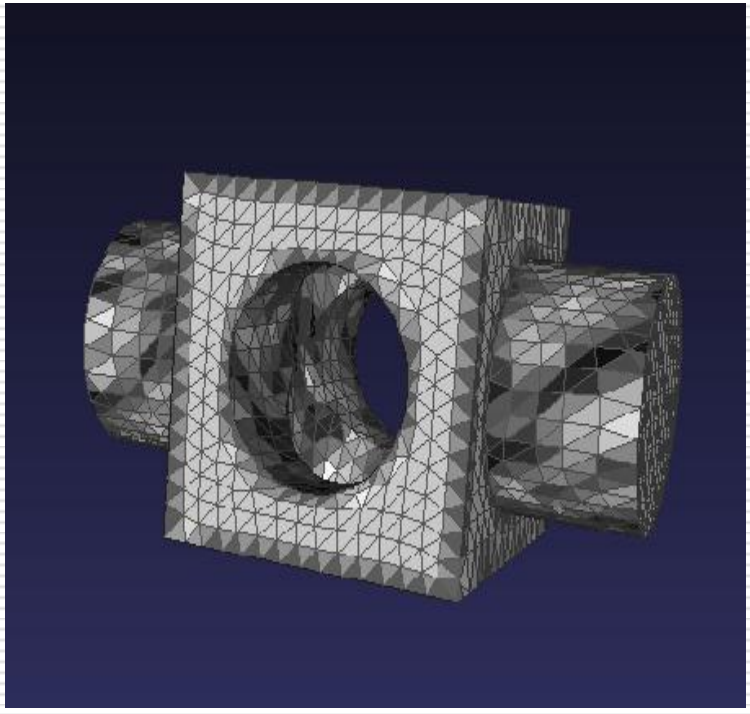
MeshLab’s Mesh

MeshLab's Vertex Attributes

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

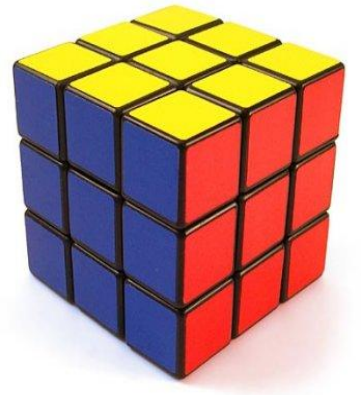
MeshLab's Face Attributes

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



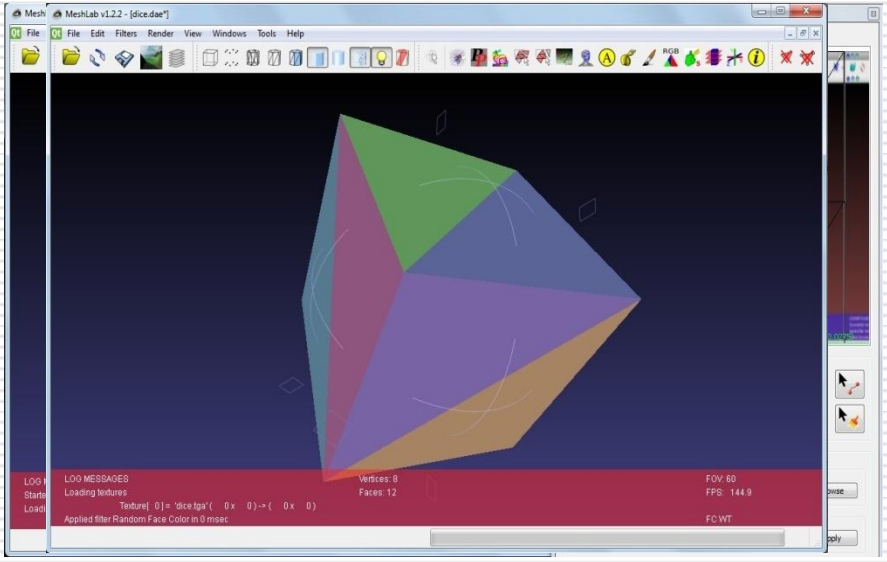
Wedge

- 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

- Texture Coords – 2d coords
- Color – rgba color
- Normal – 3d vector



Files Manipulation & Formats

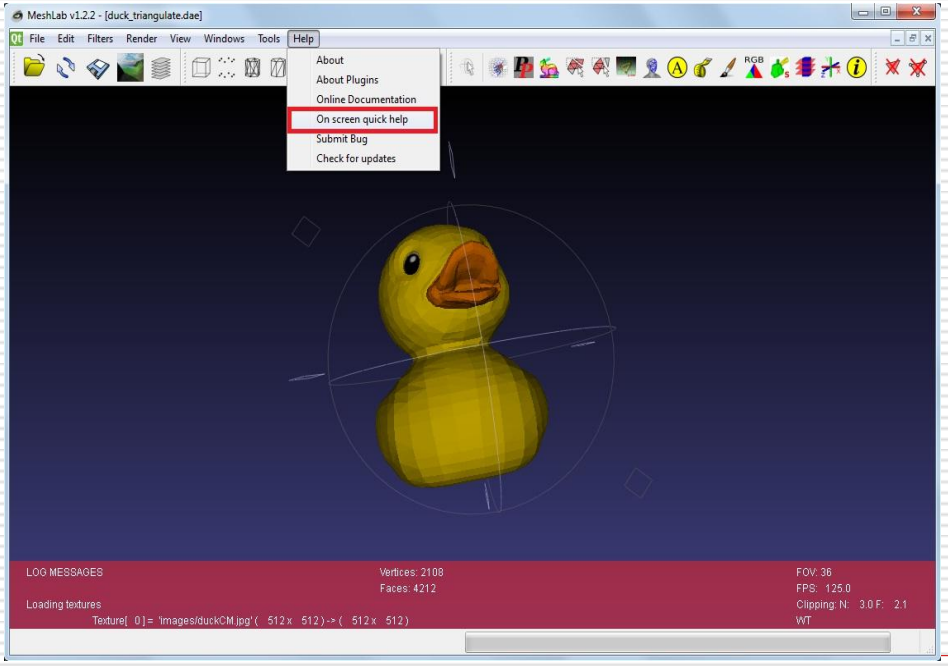
Supported File Formats

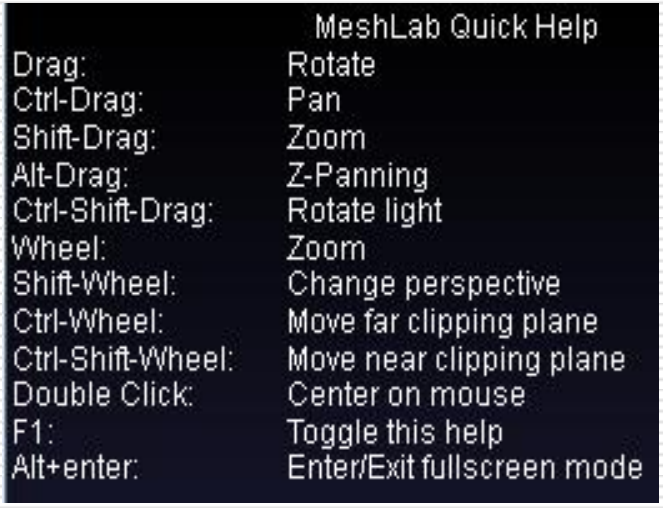
- Many Input/Output formats supported
  - **Import:**
    - PLY, STL, OFF, OBJ, 3DS, COLLADA, PTX, V3D, PTS, APTS, XYZ, GTS, PDB, TRI, ASC, X3D, X3DV, WRL, ALN…
  - **Export:**
    - PLY, STL, OFF, OBJ, 3DS, COLLADA, VRML, DXF, U3D, GTS, IDTF, X3D…
- Raster models! JPG, PNG, XPM
- Directly open and process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

TrackBall & Lighting manipulation

First of all…

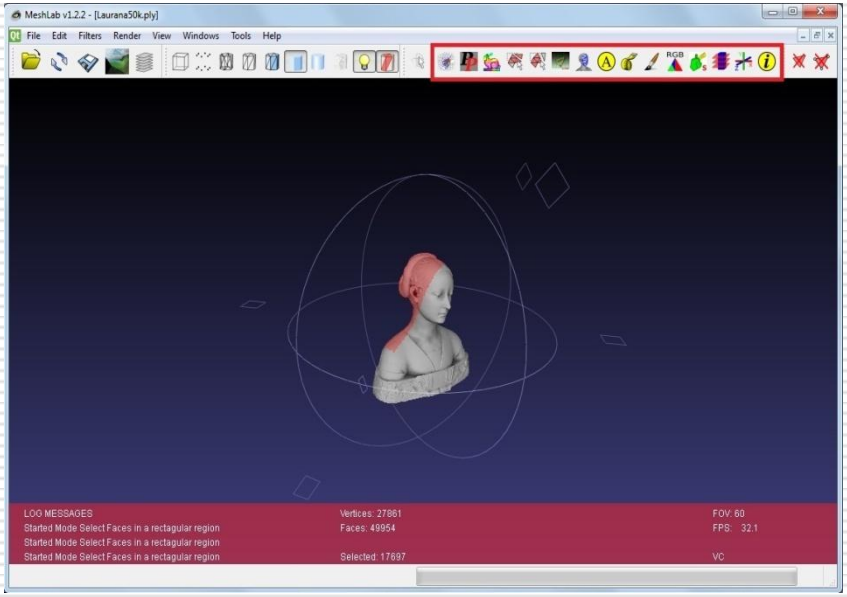
- Help->On screen quick help
- Videotutorial: http://www.youtube.com/watch?v=Sl0vJfmj5LQ&list=PL8B1E816EAE236B4D&index=1

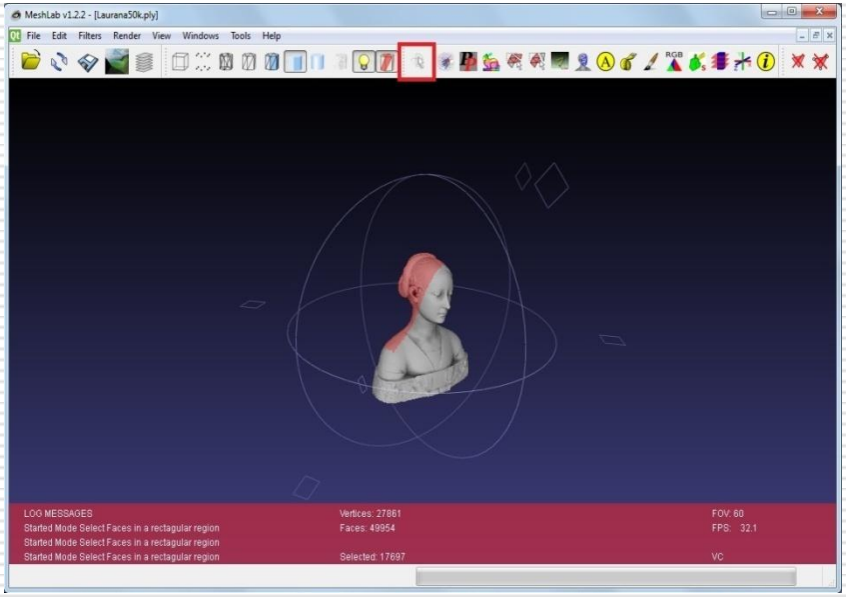




Trackball Mode

- 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



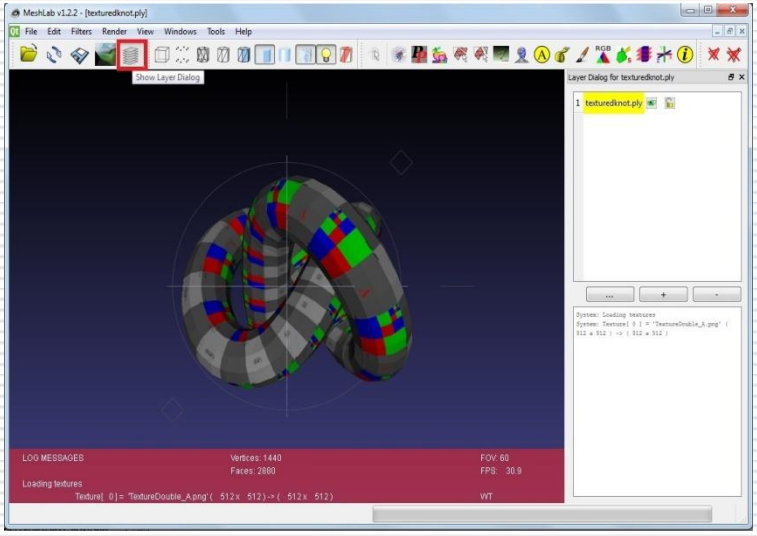


Layers Management

Layer

- Layer Dialog icon in toolbar
- Videotutorial:

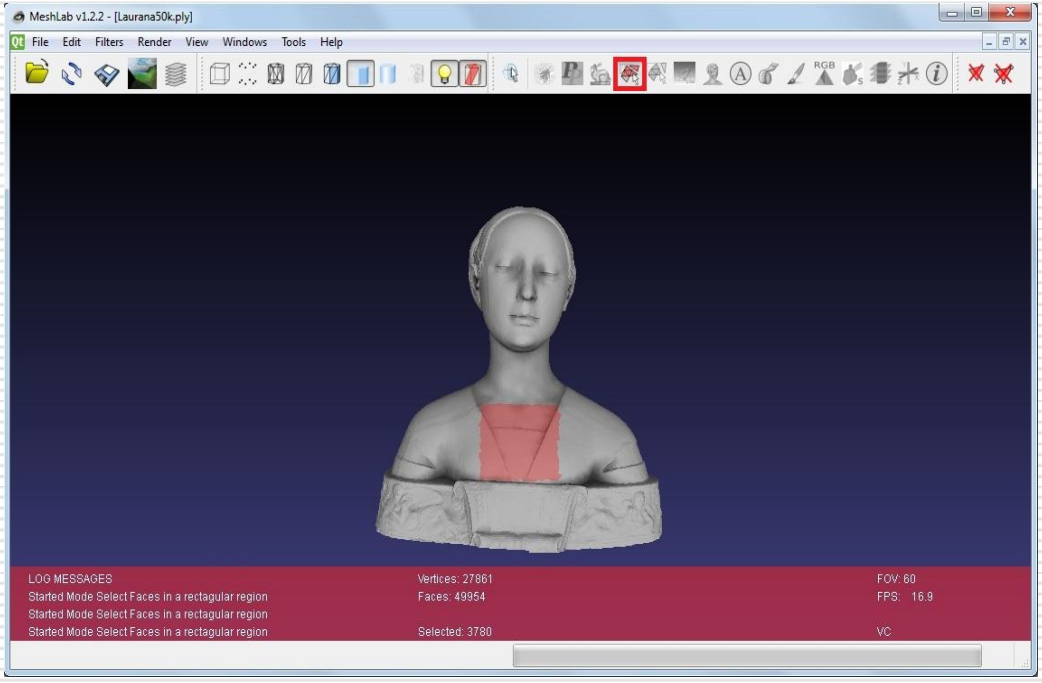
http://www.youtube.com/watch?v=-US_EJzL8Ts&list=PL8B1E816EAE236B4D&index=9



Selection Mode

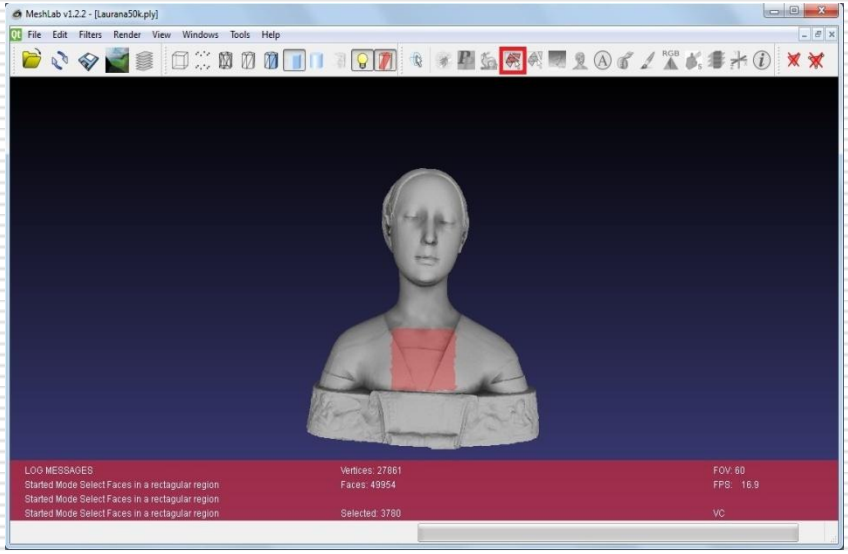
Selection (1)

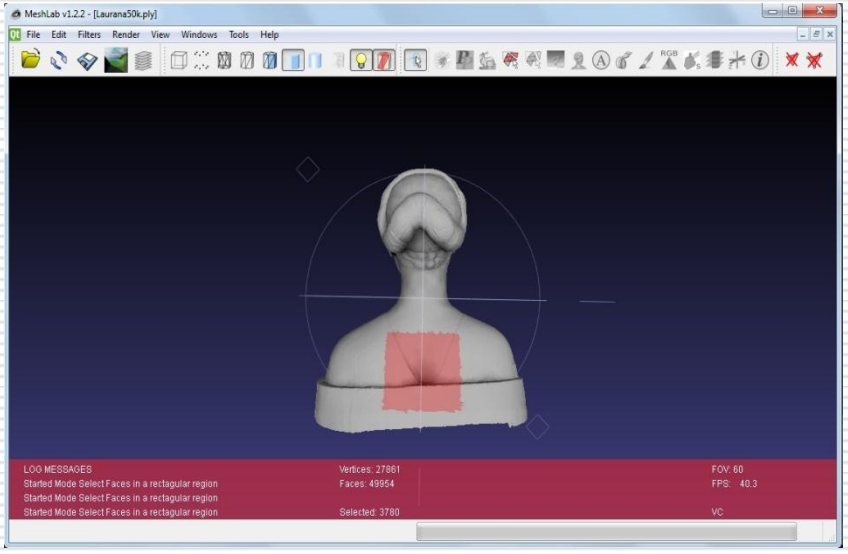
- Selection is a key operation
  - remove useless/"wrong" geometry



Selection (2)

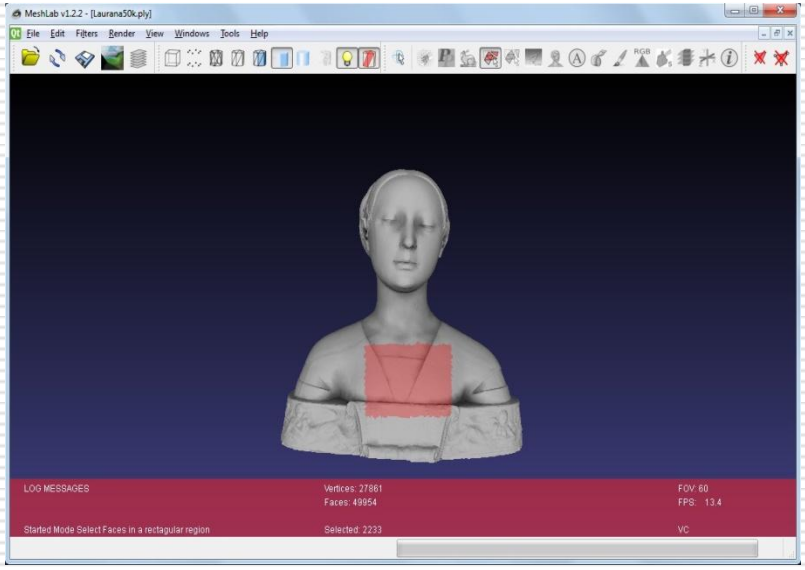
- In MeshLab many kind of selection!
- The base one is double sides selection
  - Selecting a front area means selecting also back one!

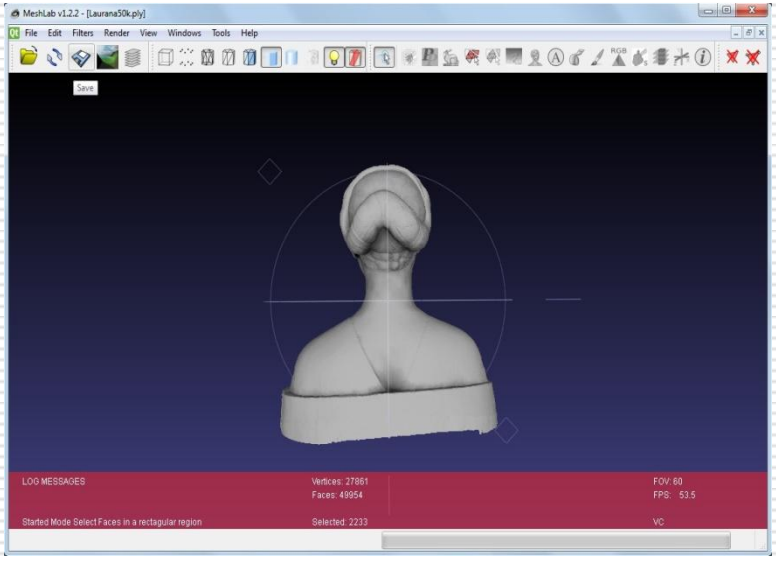




Selection (3)

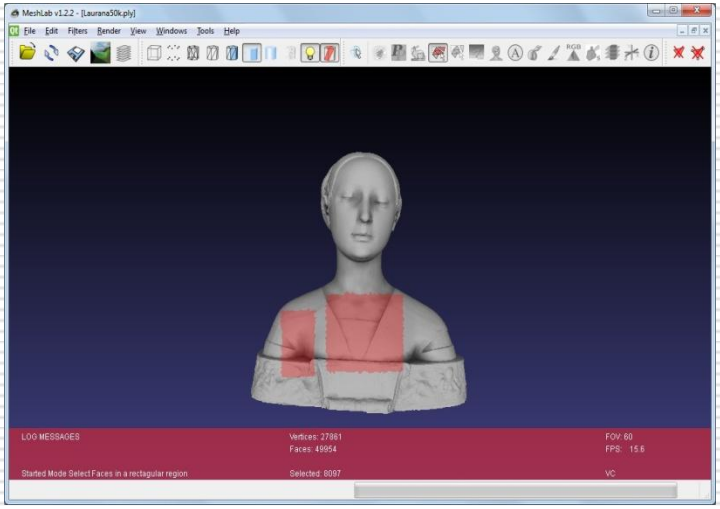
- Select only front area
  - Switch on Selection Mode
  - Alt + drag (eye icon)

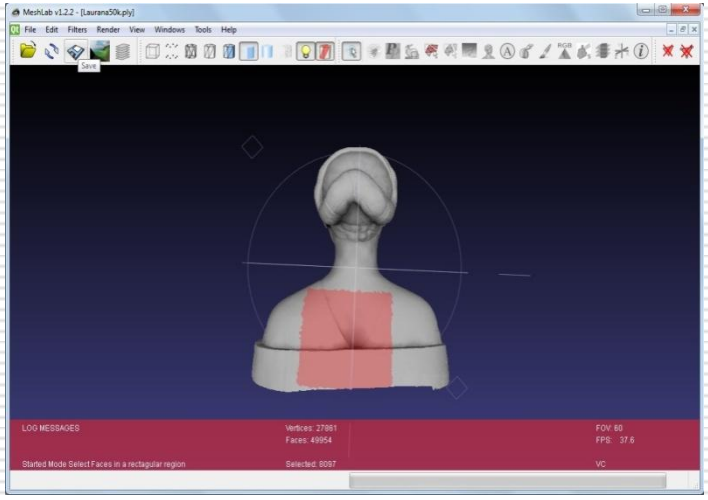




Selection (4)

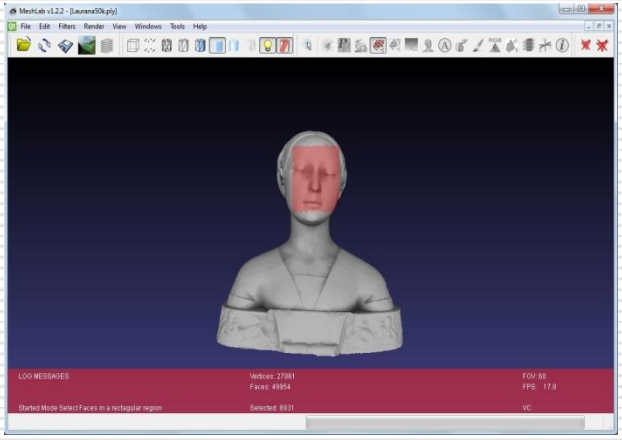
- Add a new selected area to a previous one
  - Switch on Selection Mode
  - Ctrl + drag (“+” icon)
  - Could be used in conjunction with “only front selection” (eye and “+” icon)

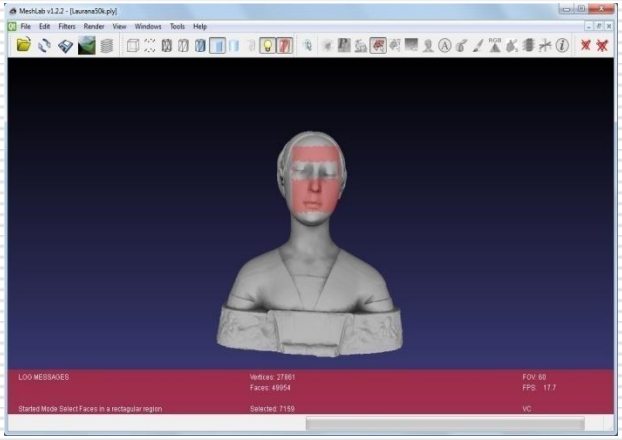




Selection (5)

- 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)
- Videotutorial: http://www.youtube.com/watch?v=xj3MN7K6kpA&list=PL8B1E816EAE236B4D&index=5



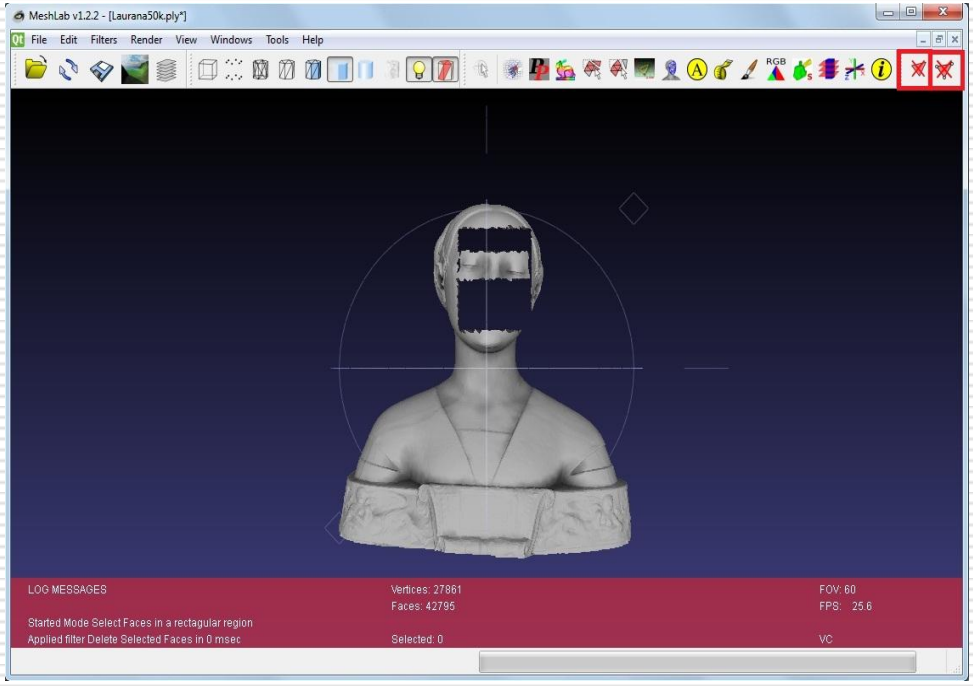


Selection (6)

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

Delete Faces and/or Vertices

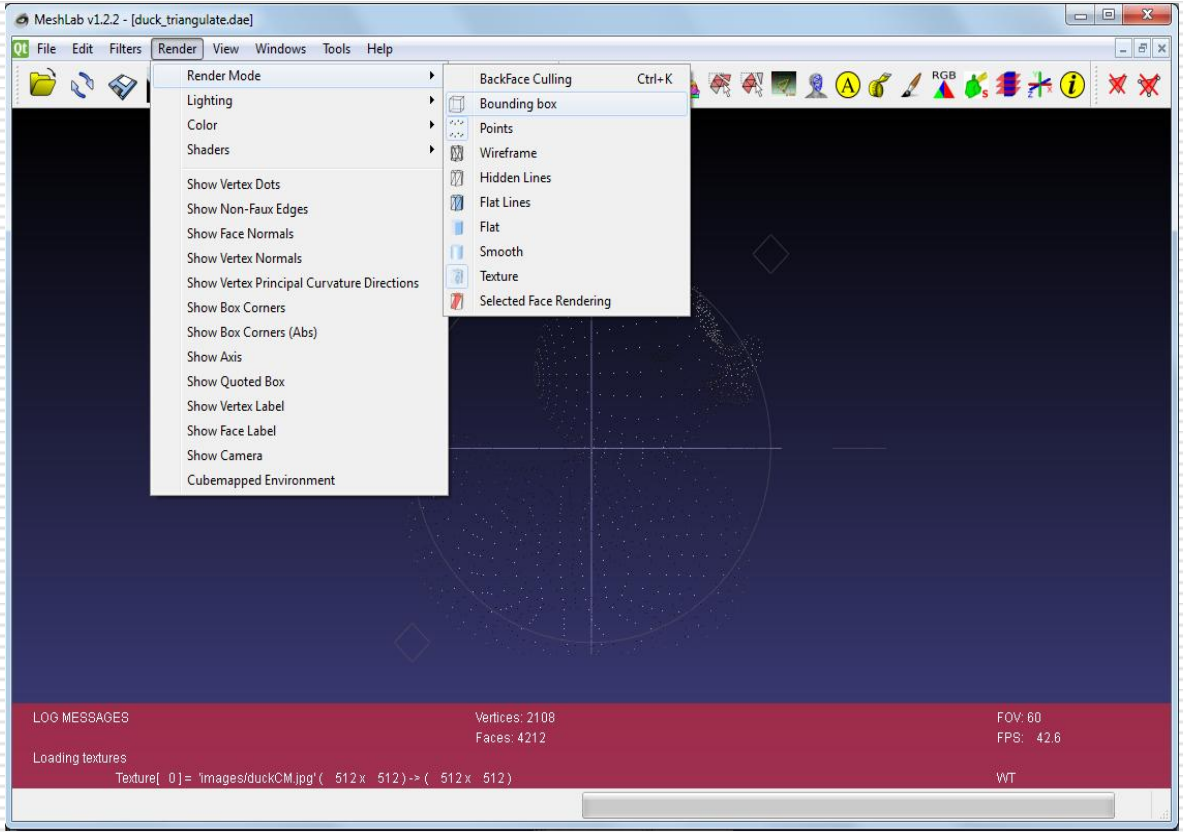
- Remove only faces (but not unref vertices)
- Remove faces and vertices



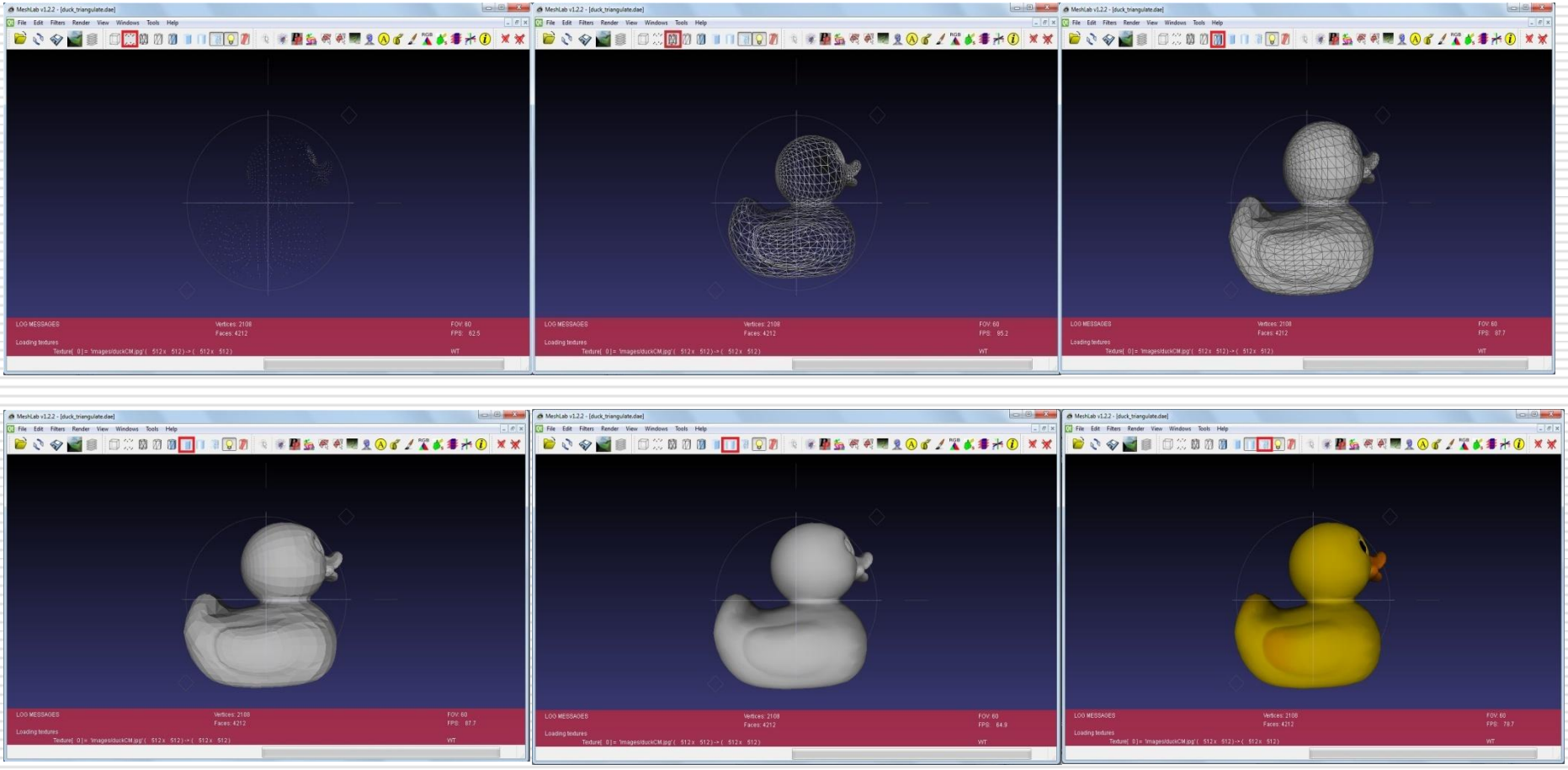
Render Mode & Shading

Render Mode

- Render->Render Mode

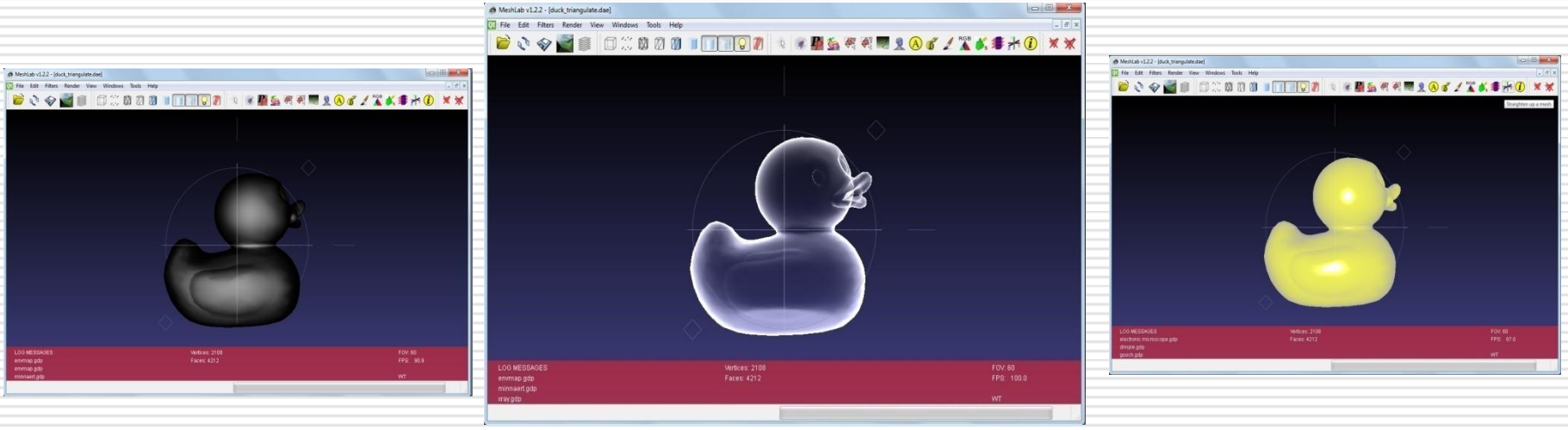


Basic Rendering Mode



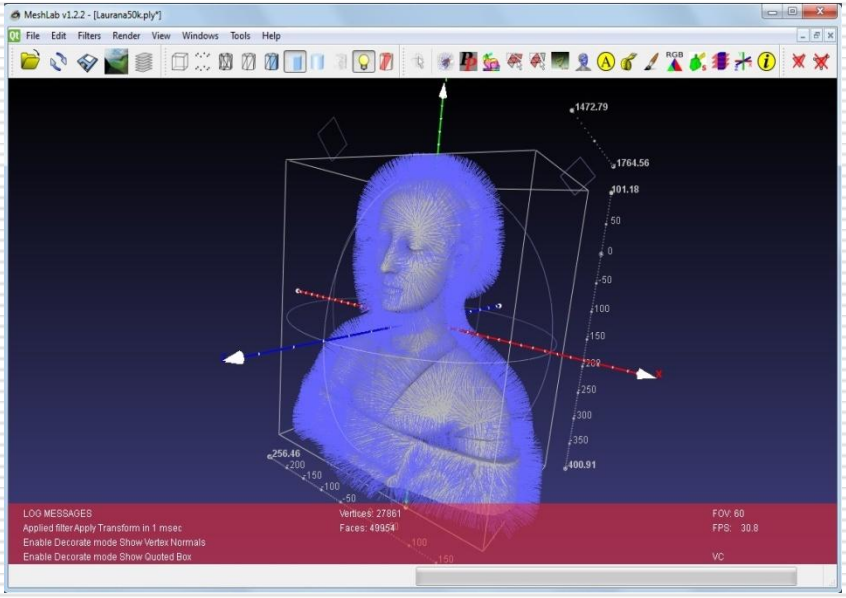
Shading Mode

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



Decorate Mode

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



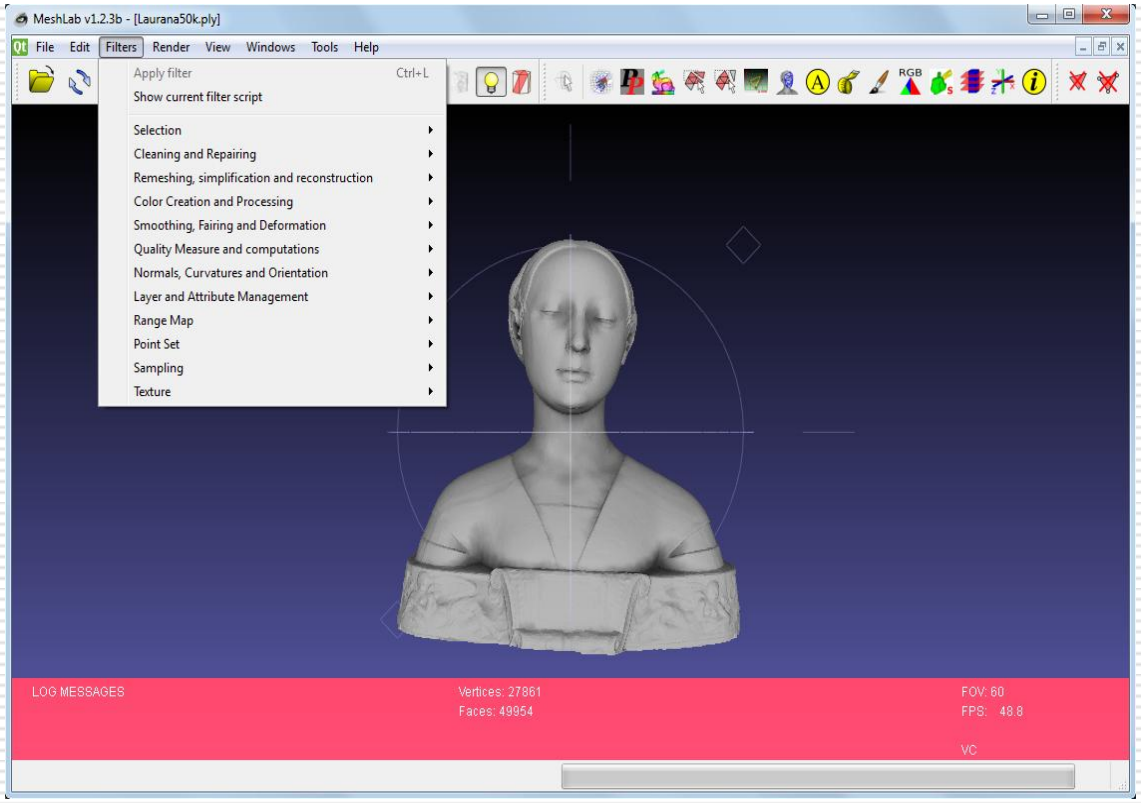
Filters and Filters' Prerequisite

Filters

- What is a Filter?!?
  - Automatic algorithm that can be applyed 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

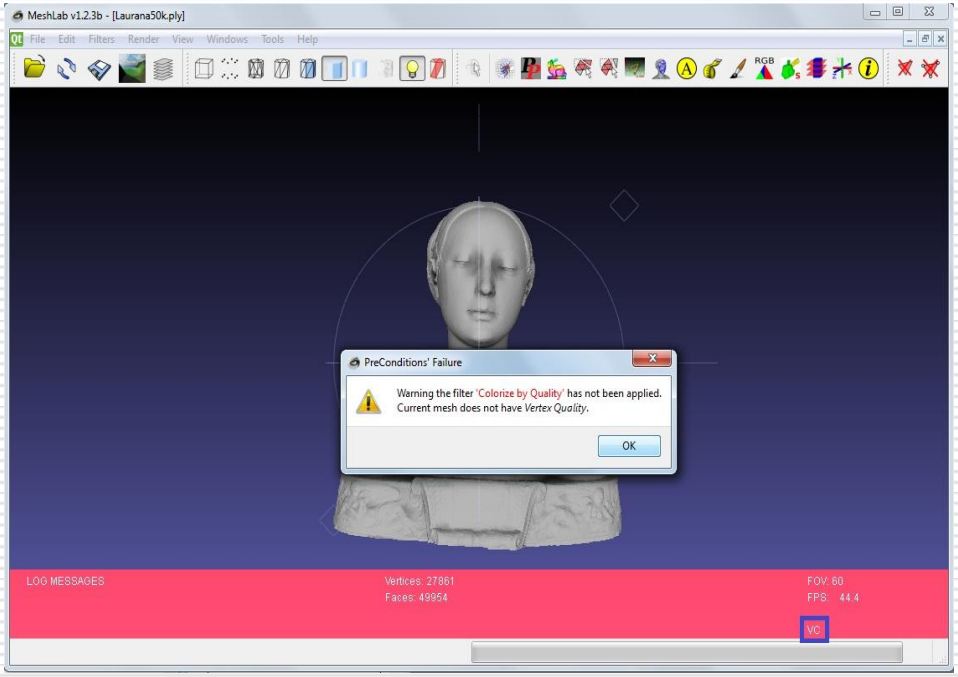
MeshLab's Filters

- Filters Menu



Filter Prequisites

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



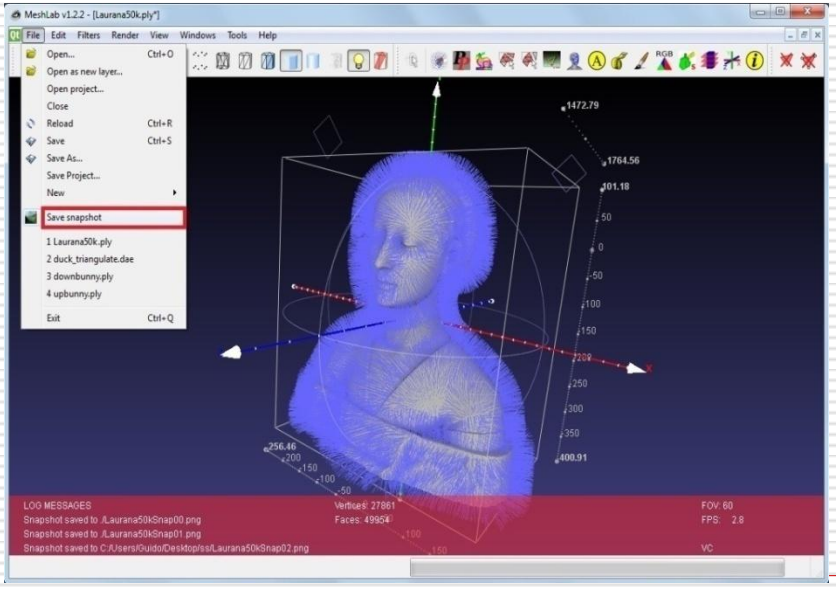
SnapShots

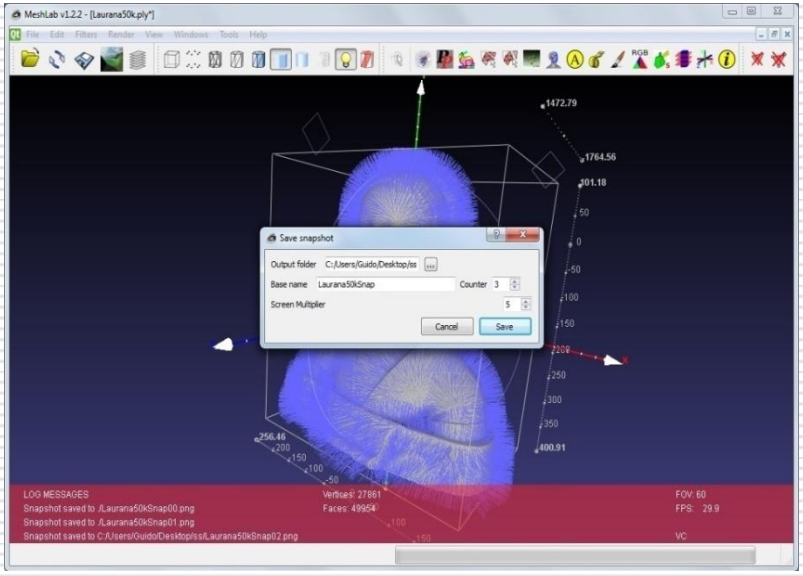
SnapShots

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

Videotutorial:

http://www.youtube.com/watch?v=wlOIfue-ilU&list=PL8B1E816EAE236B4D&index=7





Next in line…

Next lesson:

- Esempi di progetti vari

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