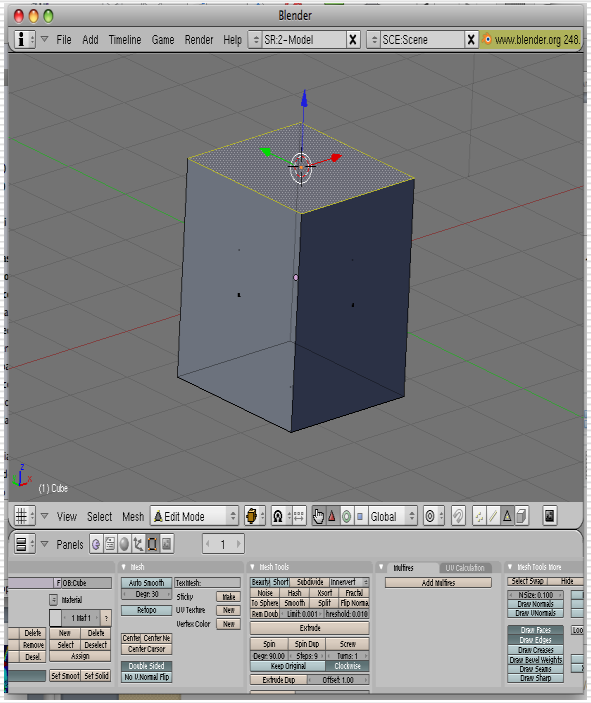
Grafica 3D per i beni culturali: MeshLab intro and basics

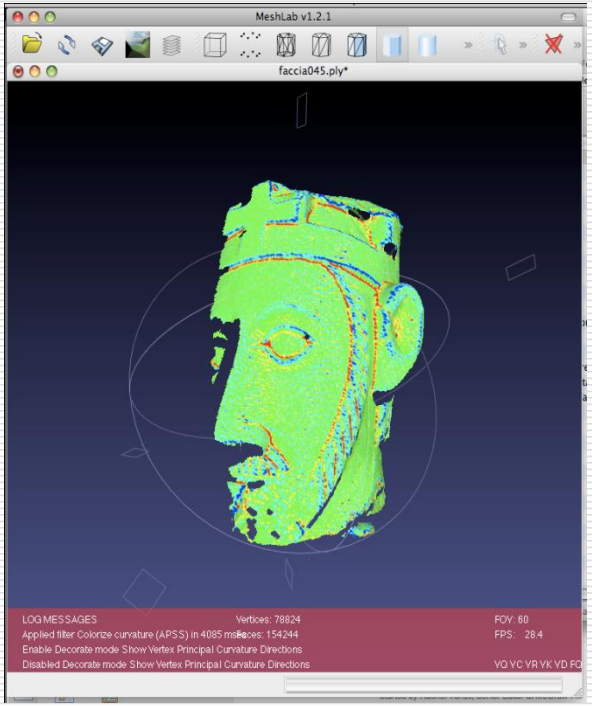
27 Febbraio - 2 Marzo 2017

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://www.meshlab. net/
- MeshLab GitHub repository
  - https://github.com/cnr-isti-vclab/meshlab
- MeshLab blog
  - http://meshlabstuff.blogspot.com/
- MeshLab forum (Help)
  - http://stackoverflow.com/questions/tagged/meshlab
- MeshLab's "fathers"
  - http://vcg.isti.cnr.it

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**

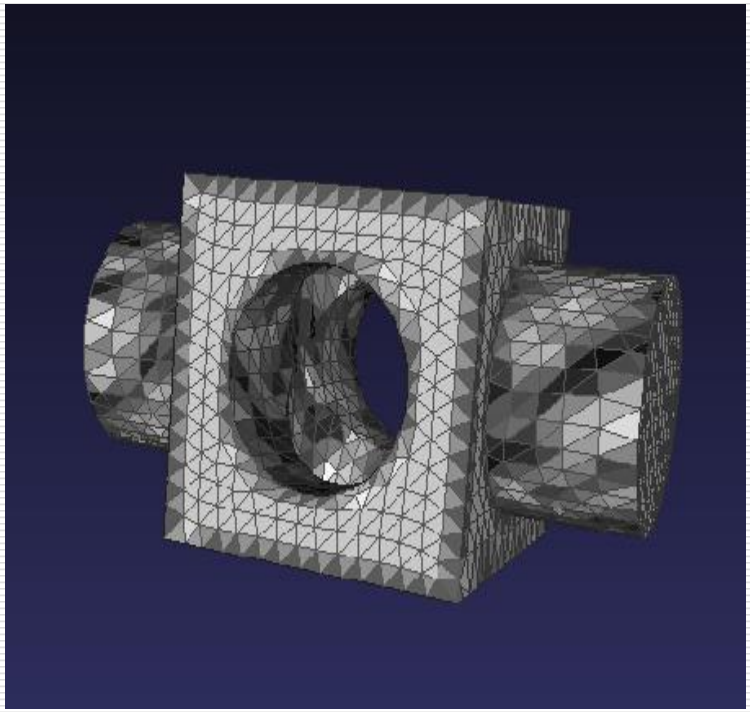
MeshLab’s Mesh

MeshLab's Vertex Attributes

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

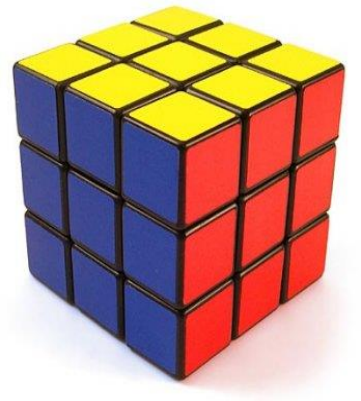
MeshLab's Face Attributes

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



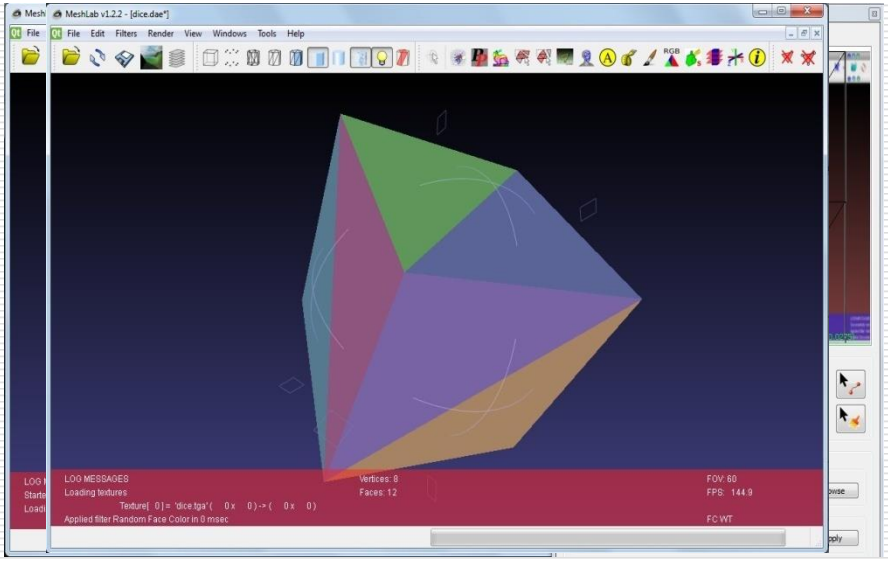
Wedge

- 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

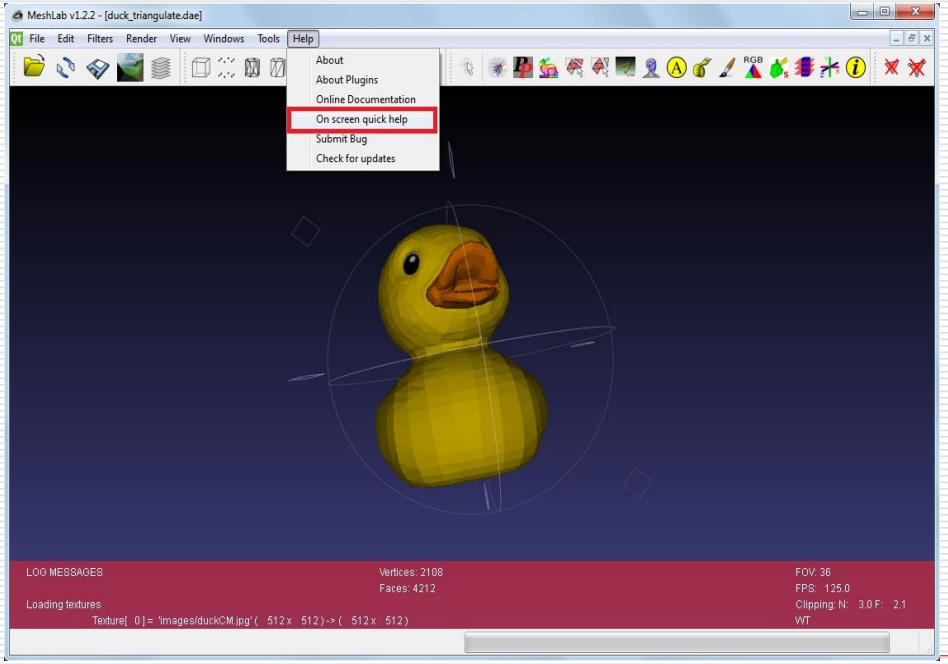
Supported File Formats

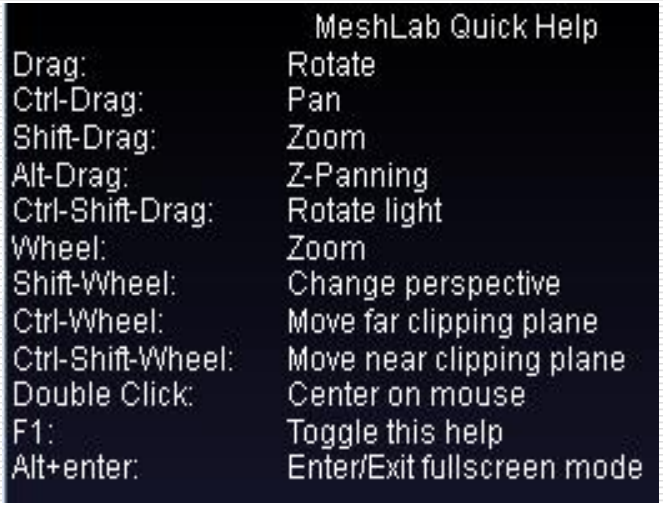
- Many Input/Output formats supported
  - **Import:**
    - PLY, STL, OFF, OBJ, 3DS, COLLADA, PTX, V3D, PTS, APTS, XYZ, GTS, PDB, TRI, ASC, X3D, X3DV, WRL, ALN…
  - **Export:**
    - PLY, STL, OFF, OBJ, 3DS, COLLADA, VRML, DXF, U3D, GTS, IDTF, X3D…
- Raster models! JPG, PNG, XPM
- Directly open and process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

MeshLab Basics

First of all…

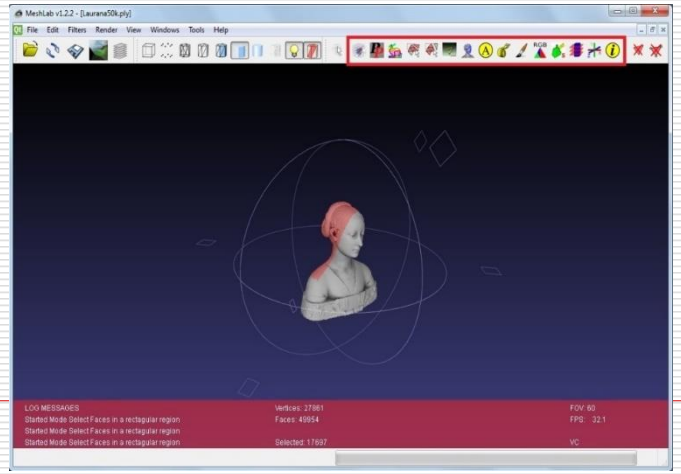
- Help->On screen quick help
- Videotutorial: http://www.youtube.com/watch?v=Sl0vJfmj5LQ&list=PL8B1E816EAE236B4D&index=1

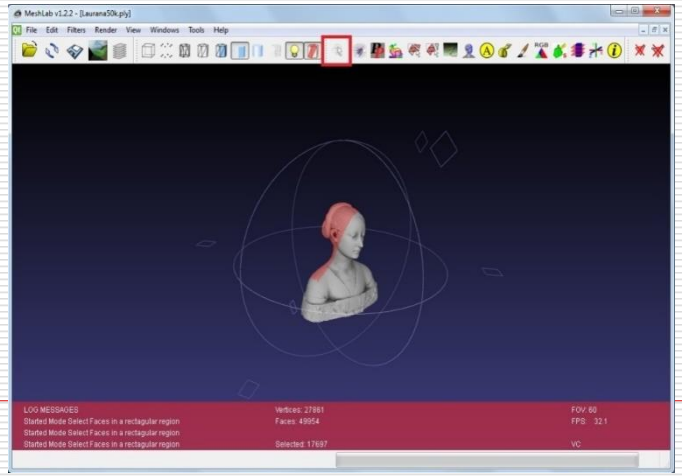




Trackball Mode

- 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
- Video tutorial: https://www.youtube.com/watch?v=Sl0vJfmj5LQ&index=5&list=PL8B1E816EAE236B4D





Handling light

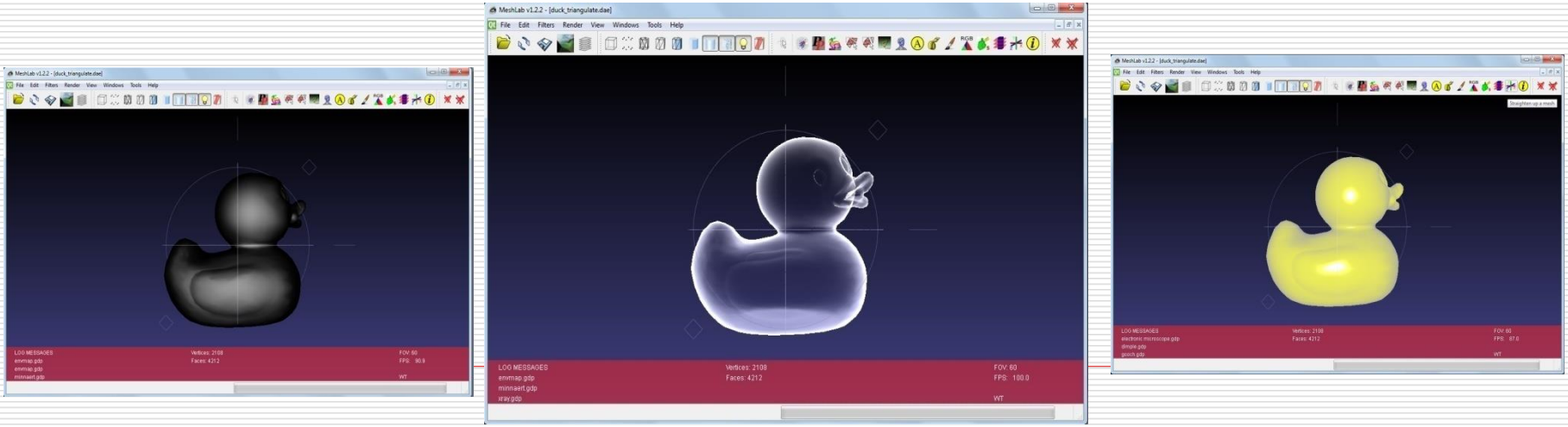
- It’s possible to change light direction using ctrl+shift+drag
- There’s a limited possibility to change the light environment
- Video tutorial: https://www.youtube.com/watch?v=mZrD9r156AQ&t=7s&index=6&list=PL8B1E816EAE236B4D

Render Mode

- Each single layer can be visualized in an independent fashion
- Tutorial 1: https://www.youtube.com/watch?v=UtbCmaLy5Ek&t=2s&index=7&list=PL8B1E816EAE236B4D
- Tutorial 2: https://www.youtube.com/watch?v=5vunGiT-oaA&t=2s&index=8&list=PL8B1E816EAE236B4D

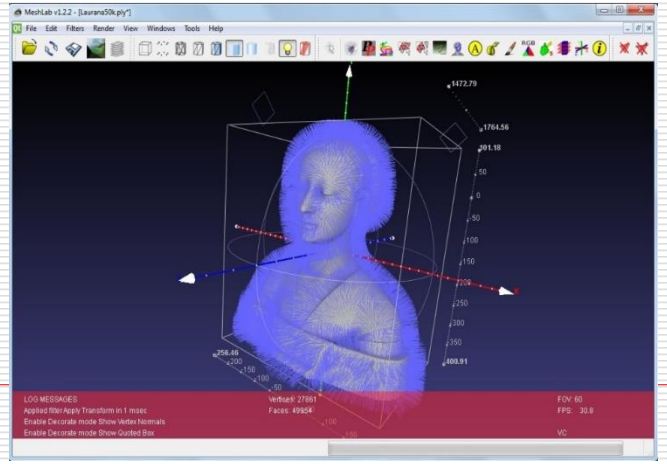
Shading Mode

- Shading Model == a computational model to simulate how light interact with a 3d Object
- Render->Shader
- Tutorial: https://www.youtube.com/watch?v=oeqYgmCcF1M&index=20&list=PL8B1E816EAE236B4D



Decorate Mode

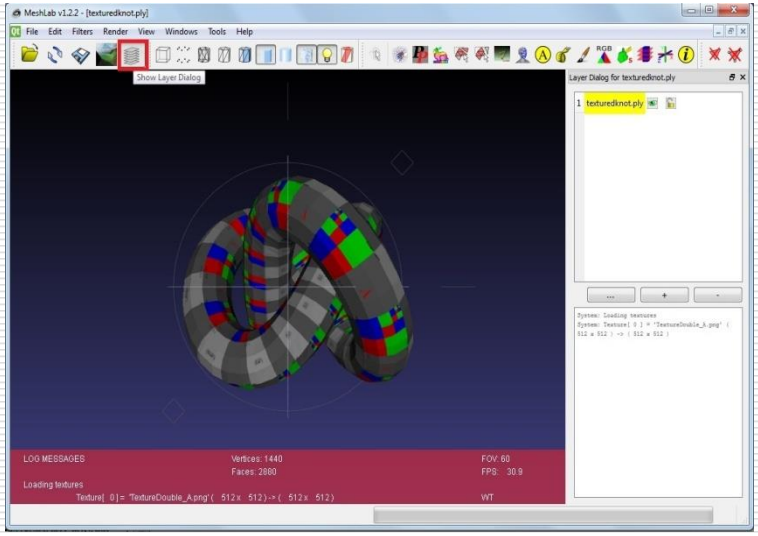
- Render submenu
- Adding visual info of the Mesh
  - Per face/vertex normals
  - Mesh's Bounding box (quoted)
  - Principal axis
- Tutorial: https://www.youtube.com/watch?v=CJ_b2zawtDg&t=11s&index=9&list=PL8B1E816EAE236B4D



Layers management

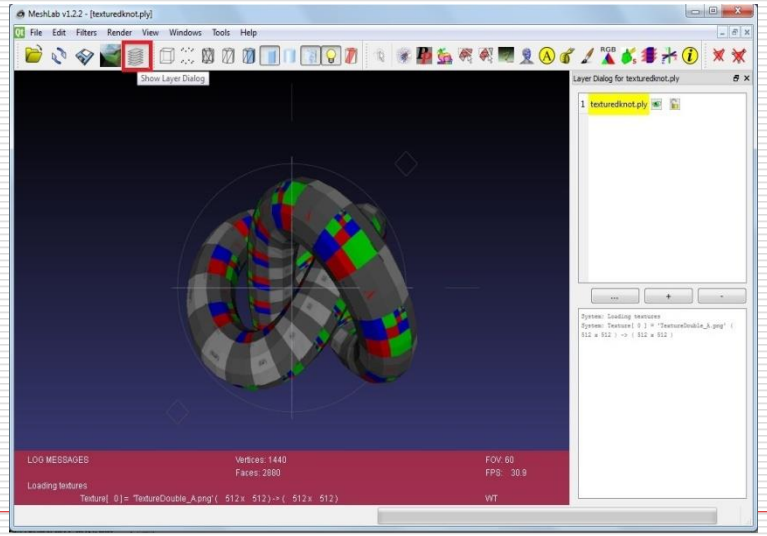
- Layer Dialog icon in toolbar
- Videotutorial:

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



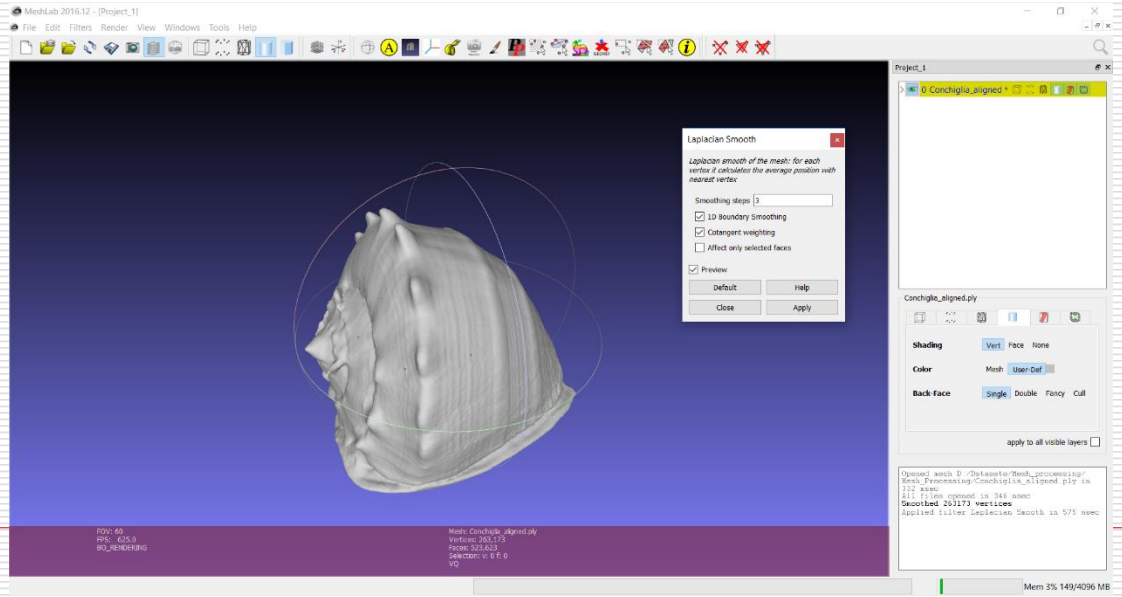
MeshLab project

- Since several layers can be handles at the same time, there's a concept of MeshLab project (.mlp) which can be saved and loaded in a second stage
- Videotutorial: https://www.youtube.com/watch?v=j-3IXWhprLs&index=16&list=PL8B1E816EAE236B4D



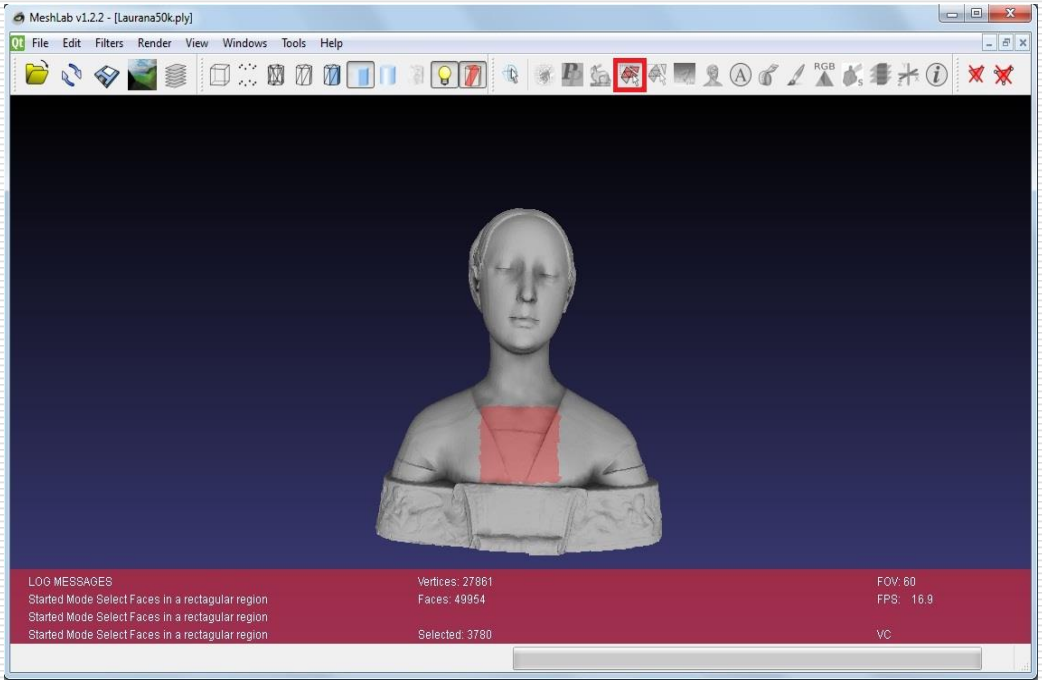
Preview and help

- MeshLab has NO CTRL+Z functionality, but preview and help can help, together with frequent savings
- Videotutorial: https://www.youtube.com/watch?v=vbTuYLz8a7A&index=10&list=PL8B1E816EAE236B4D



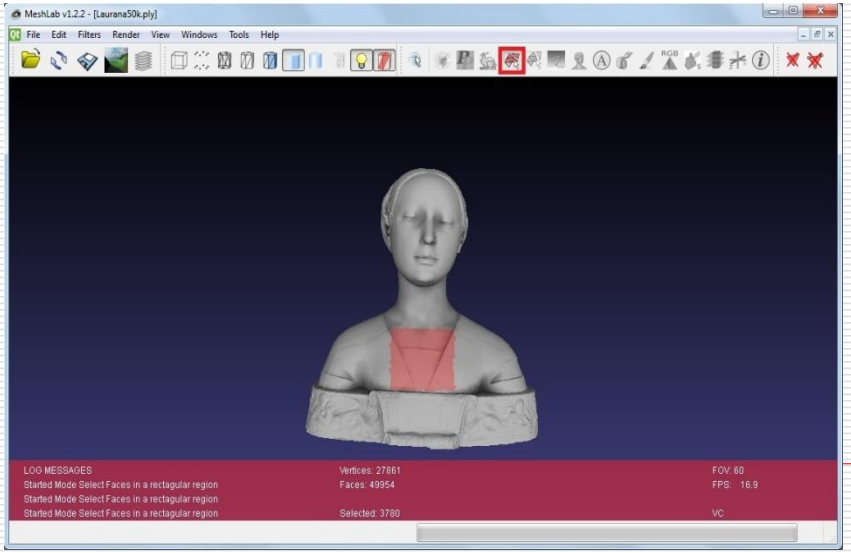
Selection (1)

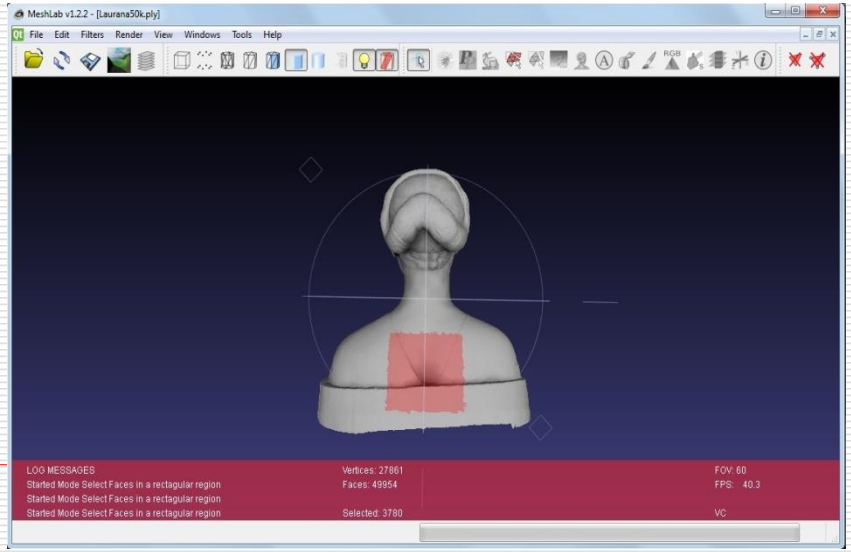
- Selection is a key operation
  - remove useless/”wrong” geometry



Selection (2)

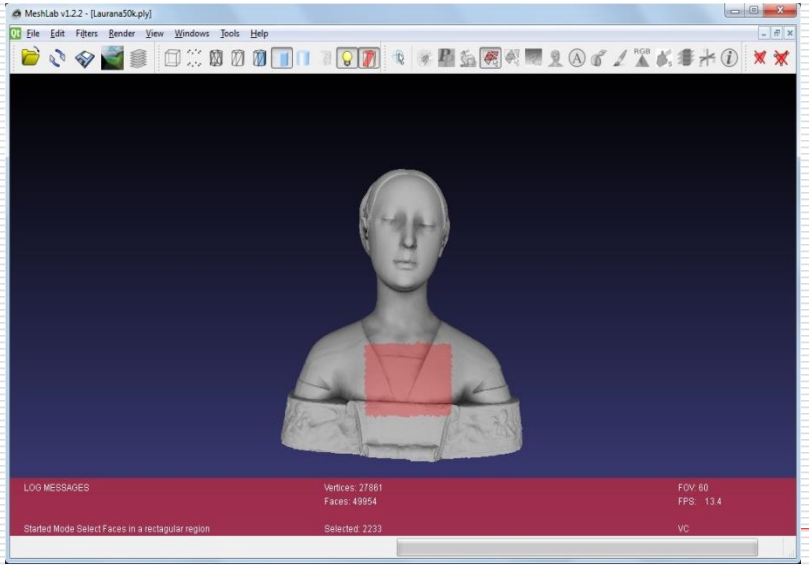
- In MeshLab many kind of selection!
- The base is rectangular selection
- Tutorial: https://www.youtube.com/watch?v=xj3MN7K6kpA&index=11&list=PL8B1E816EAE236B4D

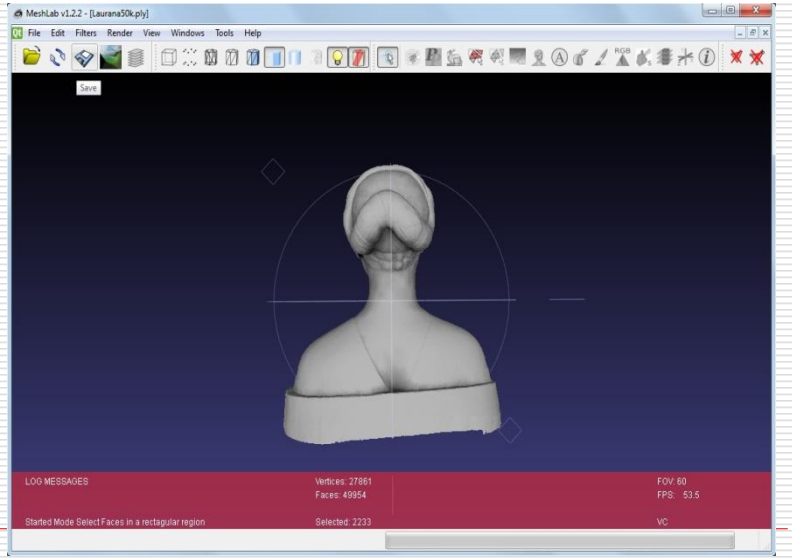




Selection (3)

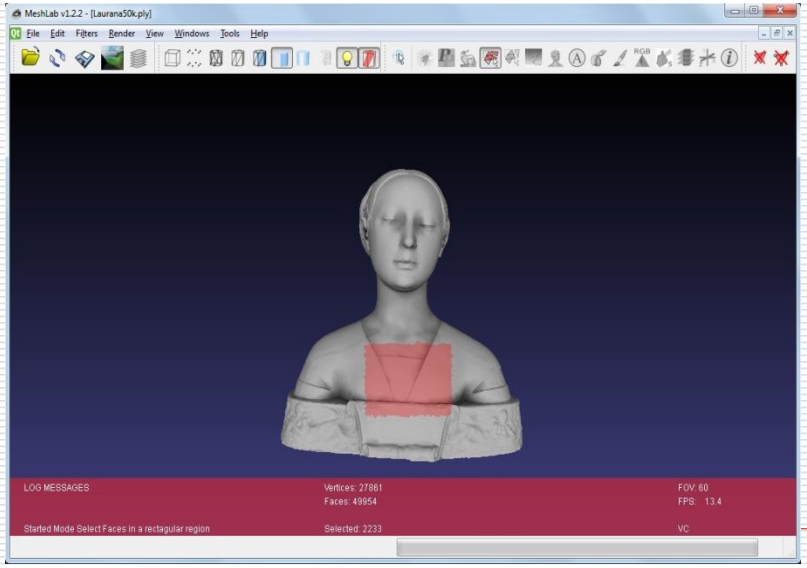
- But there are other possibilities
- Tutorial: https://www.youtube.com/watch?v=Bc3GdJ6Ddsc&index=12&list=PL8B1E816EAE236B4D

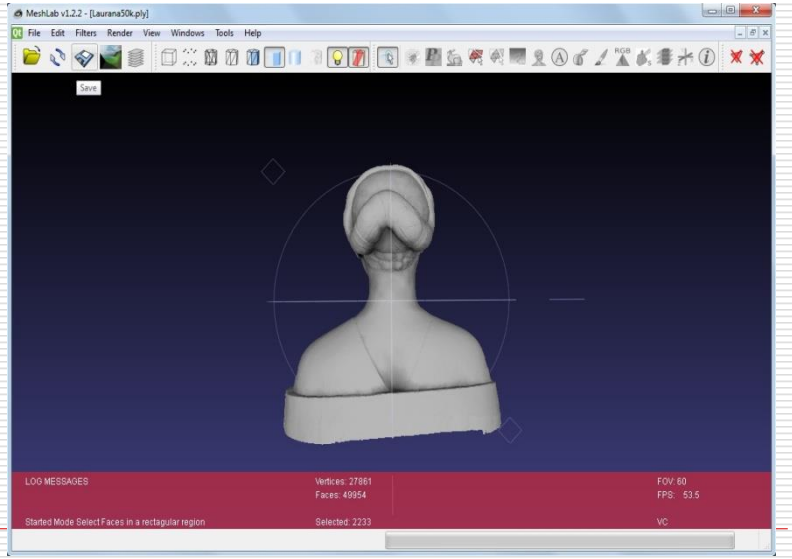




Selection (4)

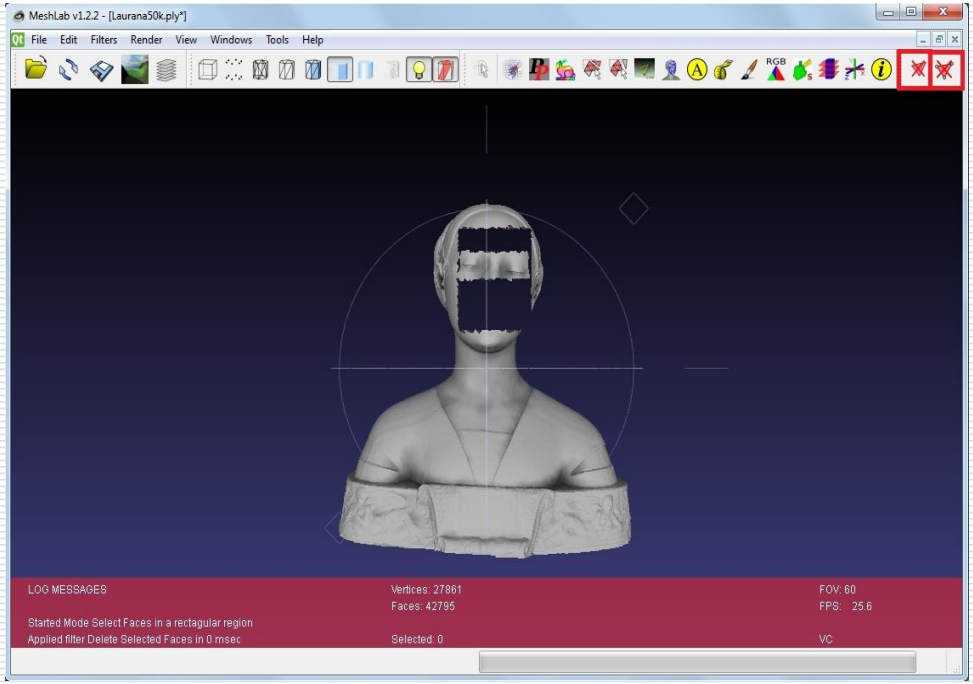
- And points are handled as well
- Tutorial: https://www.youtube.com/watch?v=Q025ayjgD5I&index=22&list=PL8B1E816EAE236B4D





Delete Faces and/or Vertices

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

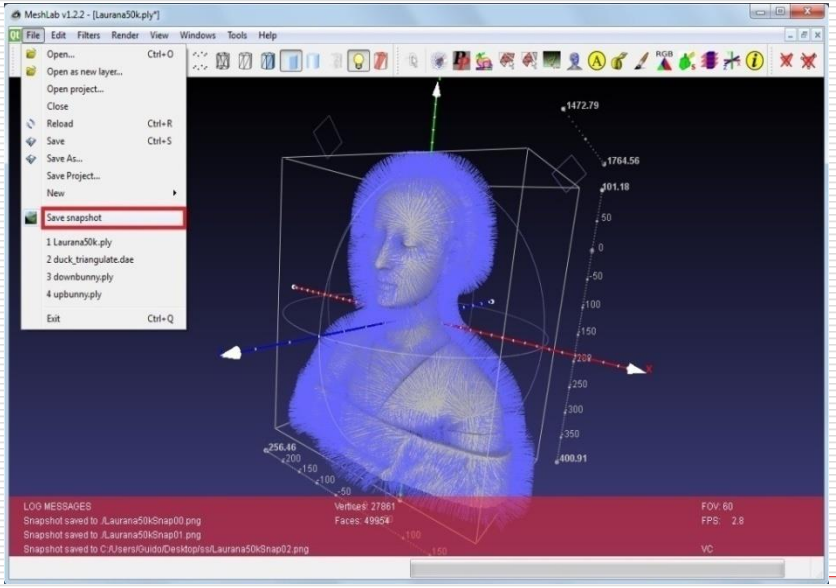


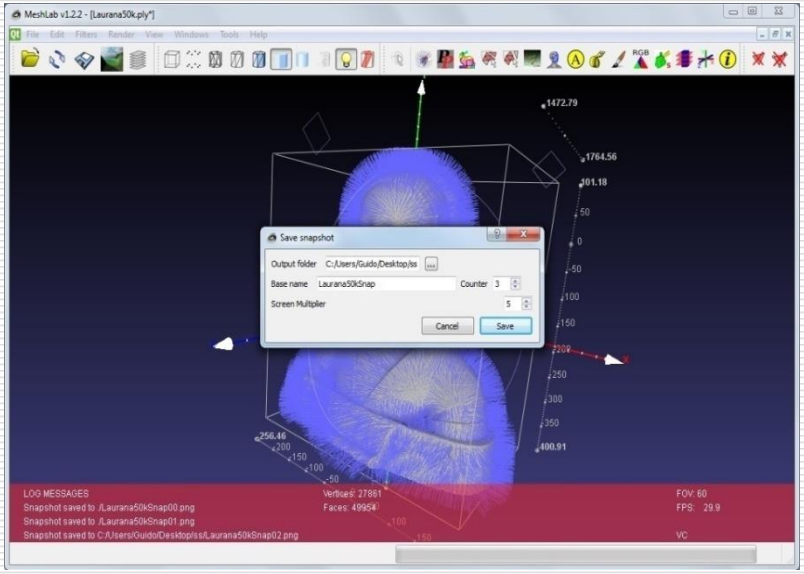
SnapShots

- 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





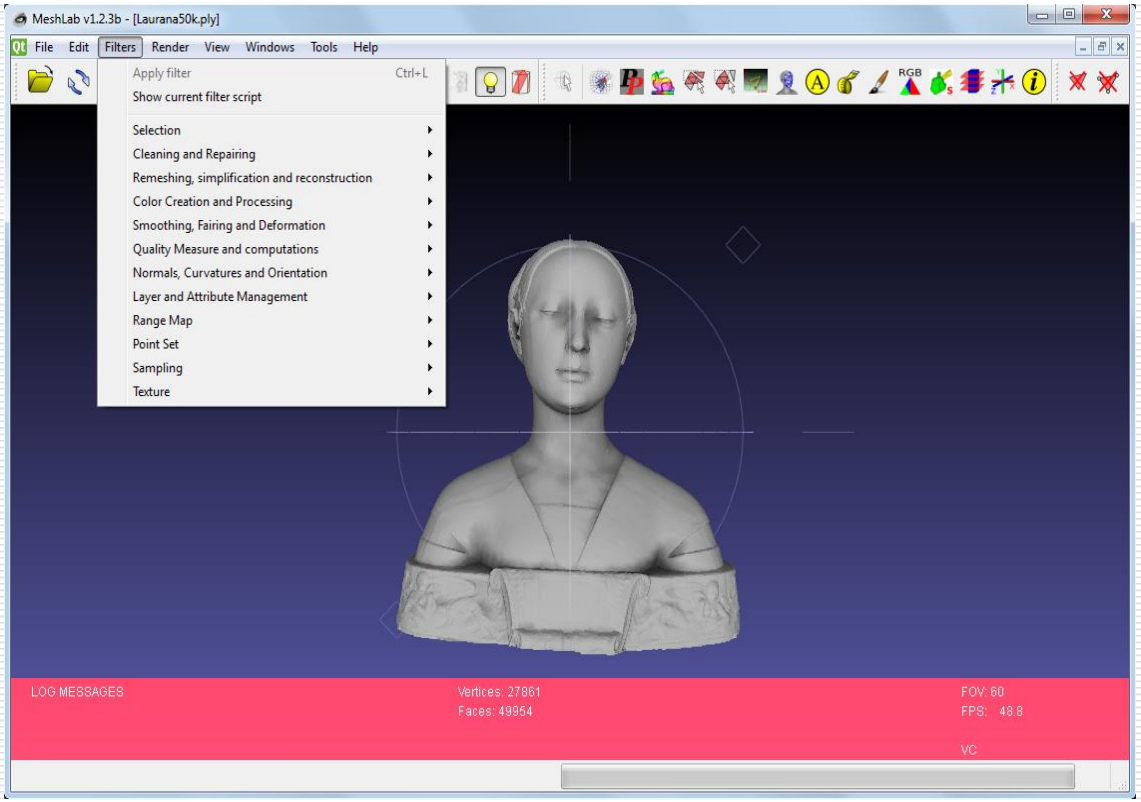
Filters and Filters' Prerequisite

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

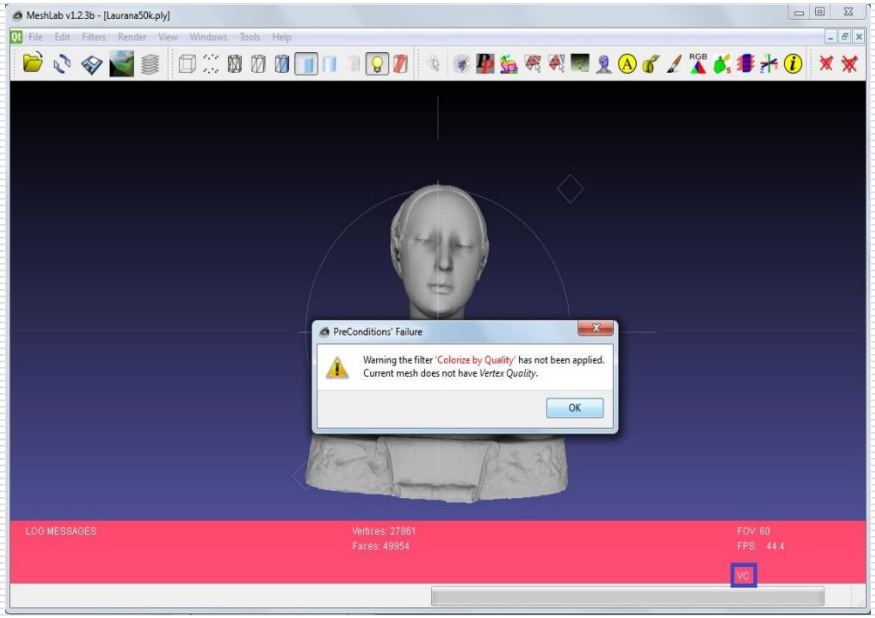
MeshLab's Filters

- Filters Menu



Filter Prequisites

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



Next in line…

Next lesson:

- MeshLab mesh processing

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