

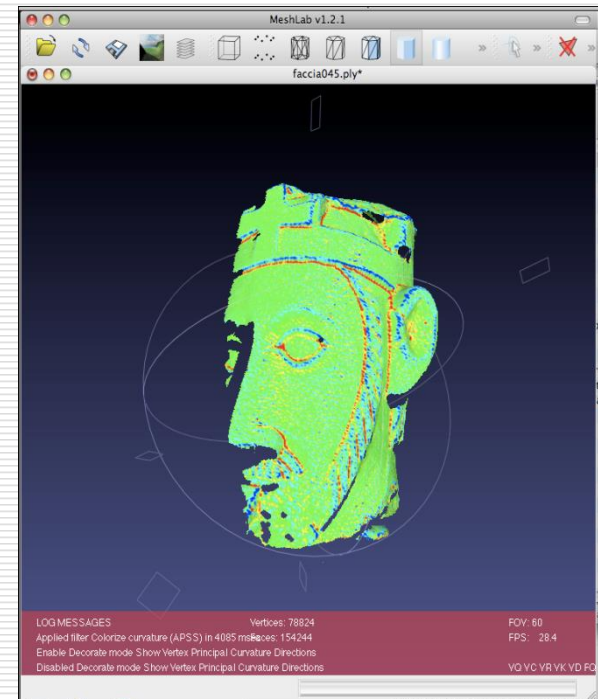
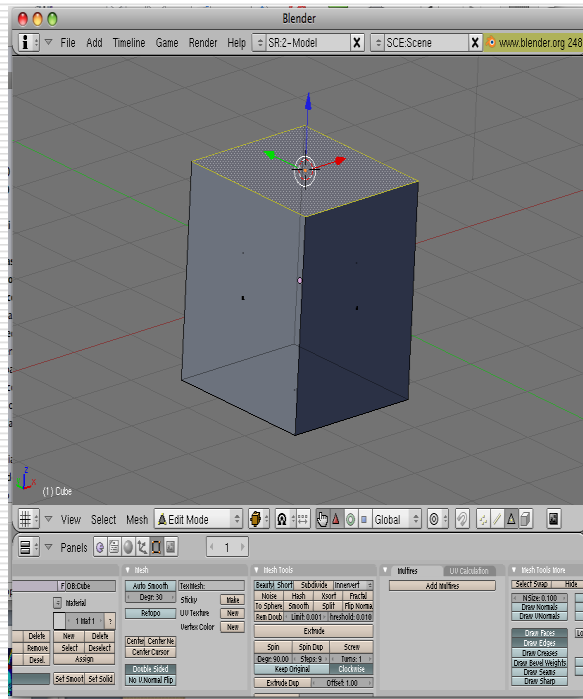


# **Grafica 3D per i beni culturali: MeshLab intro and basics**

27 Febbraio - 5 Marzo 2018

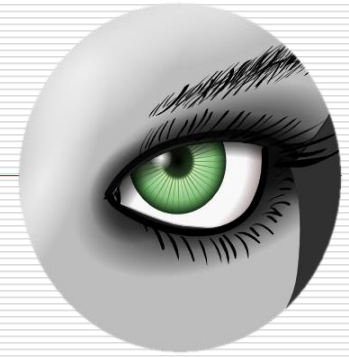
# Editing vs Processing

- ❑ 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://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?!?

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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>

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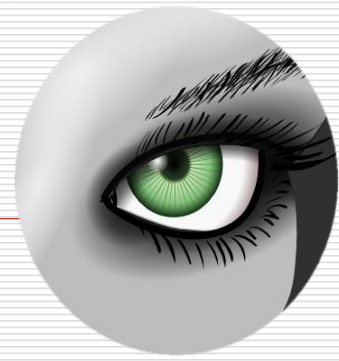
# MeshLab Philosophy

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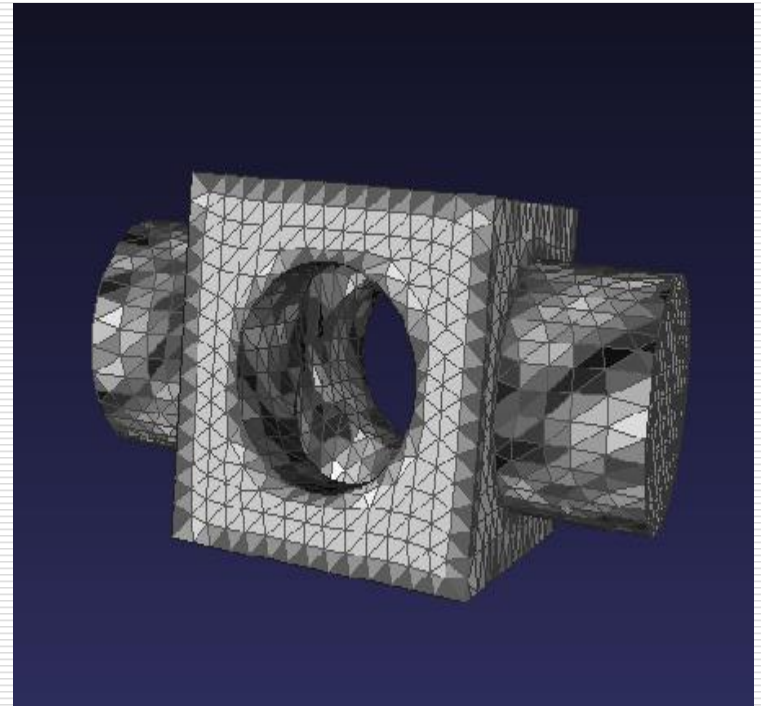
- ❑ Position - 3d coords
- ❑ Normal - 3d vector
- ❑ Color - rgba color
- ❑ Texture Coordinates - 2d coords
- ❑ Quality - number
- ❑ Some other stuff (flags, radius)



# MeshLab's Face Attributes

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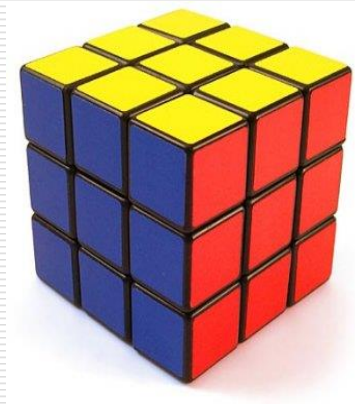
- Color – rgba color
- Normal – 3d vector
- Quality – number
- Vertices' indices – 3 indices



# 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



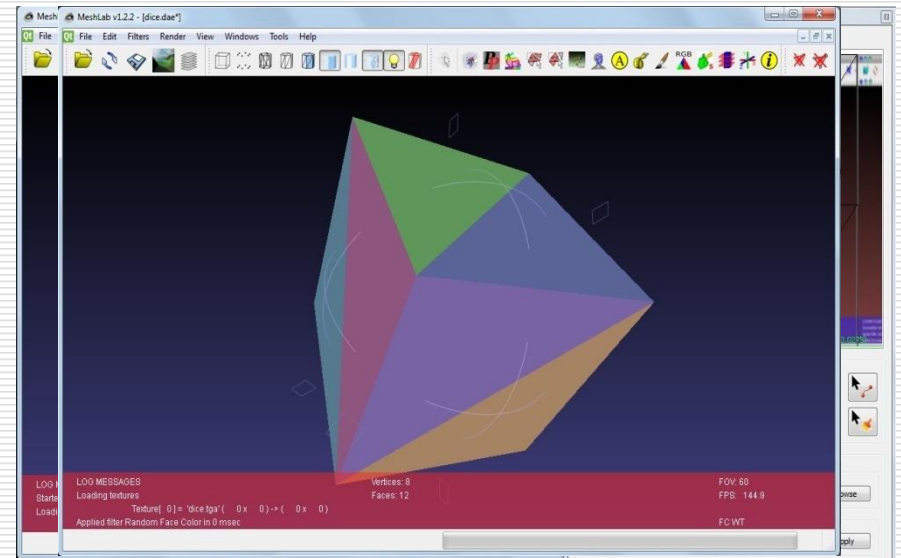
# MeshLab's Wedge

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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!!!!!!!
-

# MeshLab Basics

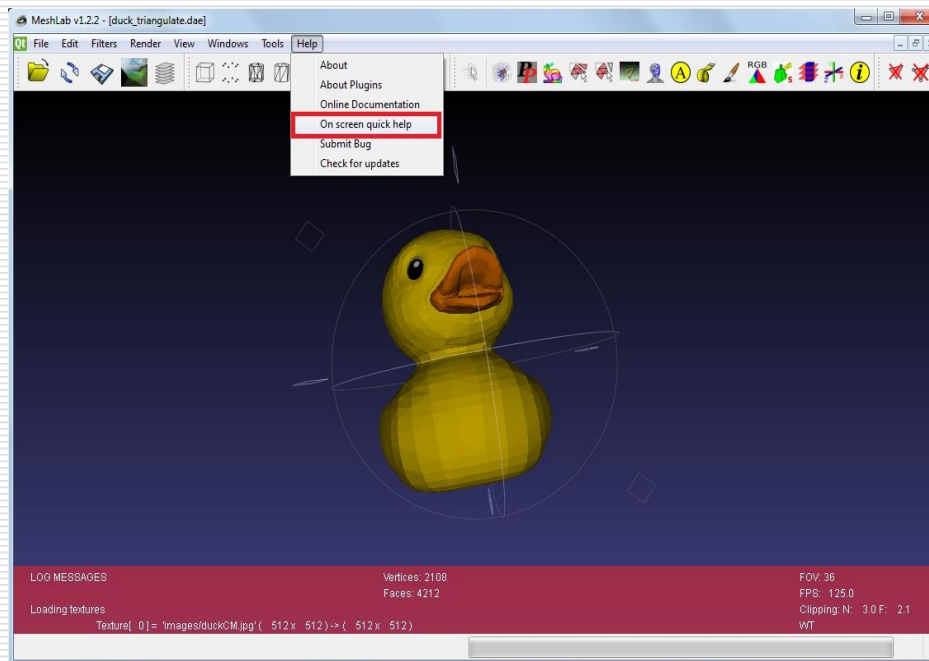


# First of all...

□ Help->On screen quick help

□ Videotutorial:

<http://www.youtube.com/watch?v=SI0vJfmj5LQ&list=PL8B1E816EAE236B4D&index=1>



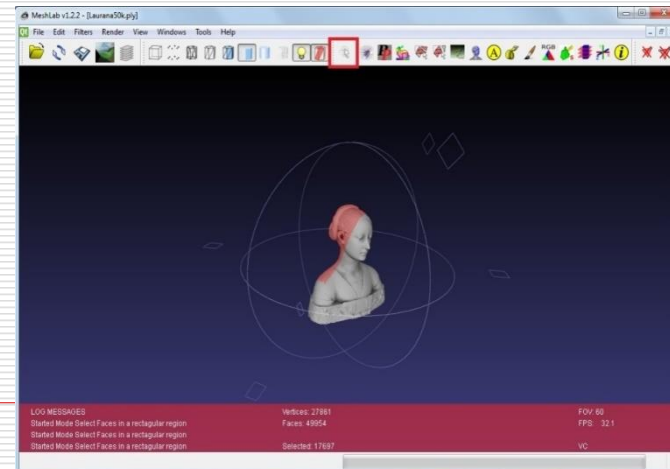
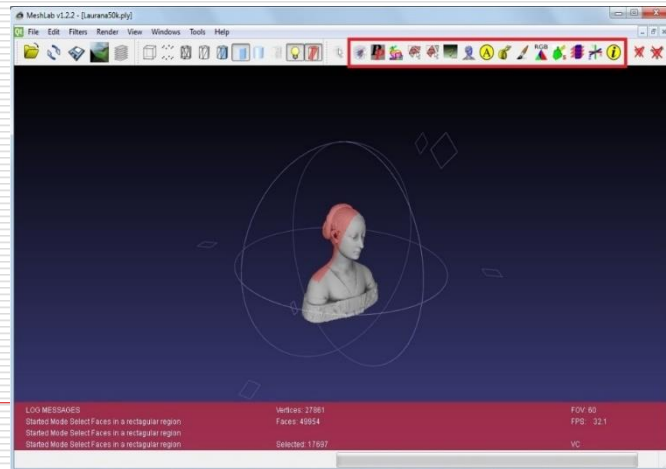
MeshLab Quick Help	
Drag:	Rotate
Ctrl-Drag:	Pan
Shift-Drag:	Zoom
Alt-Drag:	Z-Panning
Ctrl-Shift-Drag:	Rotate light
Wheel:	Zoom
Shift-Wheel:	Change perspective
Ctrl-Wheel:	Move far clipping plane
Ctrl-Shift-Wheel:	Move near clipping plane
Double Click:	Center on mouse
F1:	Toggle this help
Alt+enter:	Enter/Exit 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
- ❑ Video tutorial:  
<https://www.youtube.com/watch?v=SI0vJfmj5LQ&index=5&list=PL8B1E816EAE236B4D>



# Handling light

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- ❑ 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

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- ❑ 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-0aA&t=2s&index=8&list=PL8B1E816EAE236B4D>
-

# Shading Mode

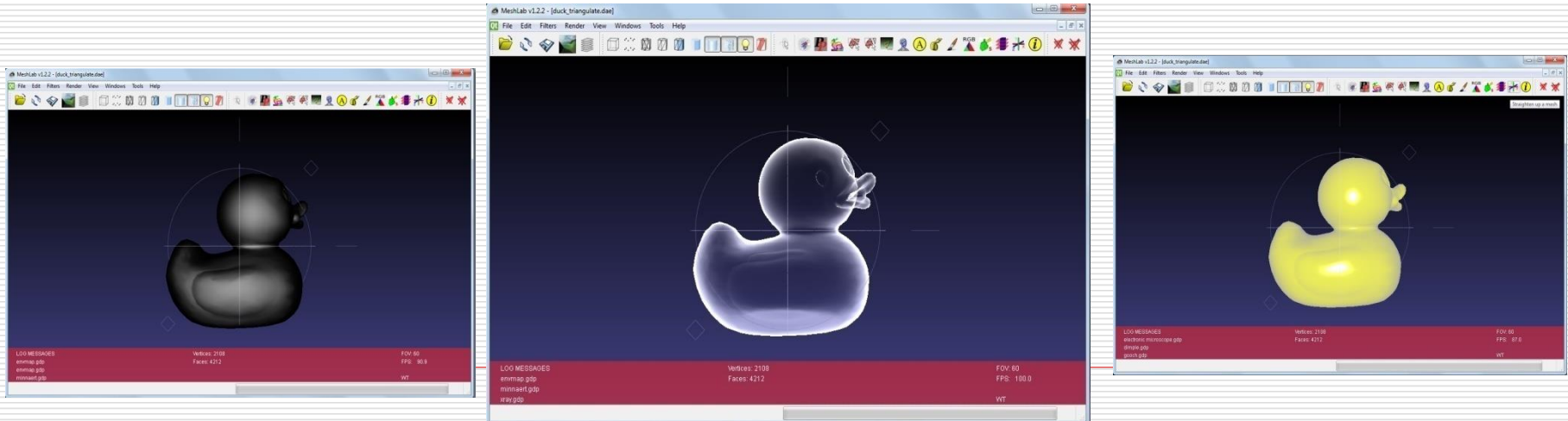
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❑ Shading Model == a computational model to simulate how light interact with a 3d Object

❑ Render->Shader

❑ Tutorial:

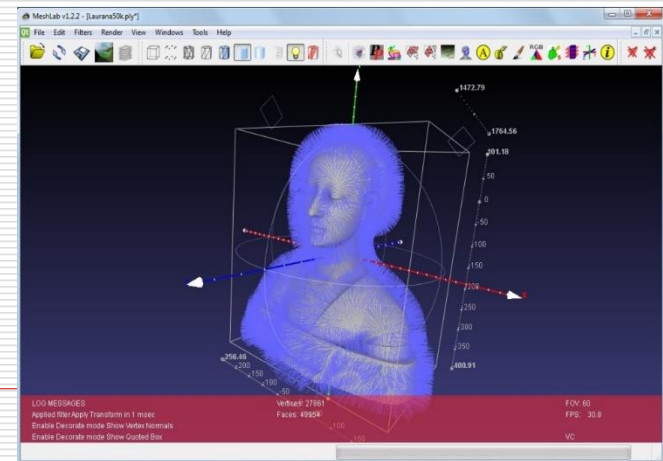
<https://www.youtube.com/watch?v=oeqYgmCcF1M&index=20&list=PL8B1E816EAE236B4D>



# Decorate Mode

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- 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](https://www.youtube.com/watch?v=CJ_b2zawtDg&t=11s&index=9&list=PL8B1E816EAE236B4D)

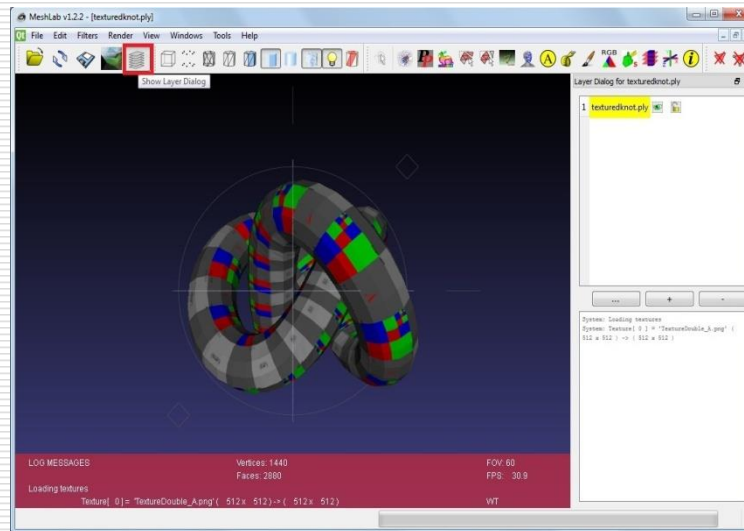


# Layers management

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- ❑ Layer Dialog icon in toolbar
- ❑ Videotutorial:

[http://www.youtube.com/watch?v=-US\\_EJzL8Ts&list=PL8B1E816EAE236B4D&index=9](http://www.youtube.com/watch?v=-US_EJzL8Ts&list=PL8B1E816EAE236B4D&index=9)



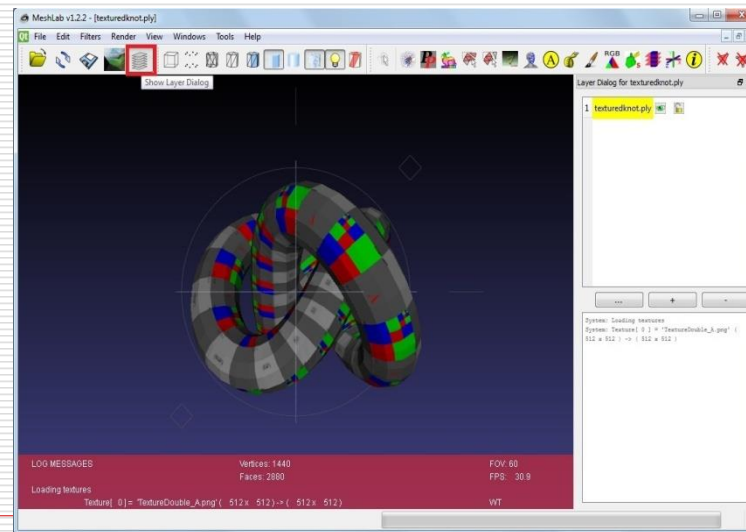
# MeshLab project

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□ 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

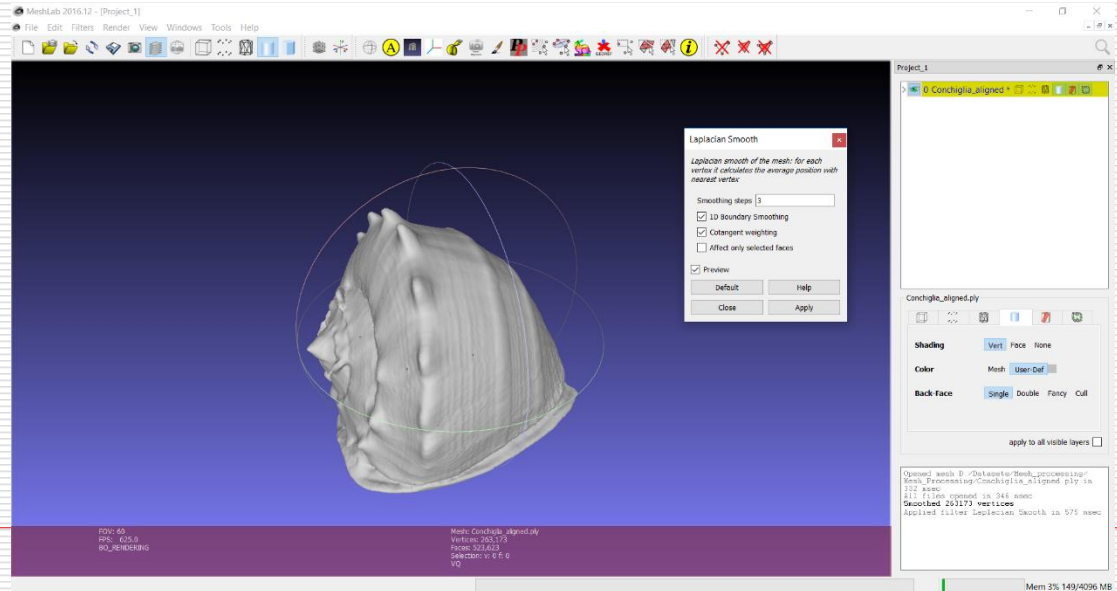
□ Videotutorial:

<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>

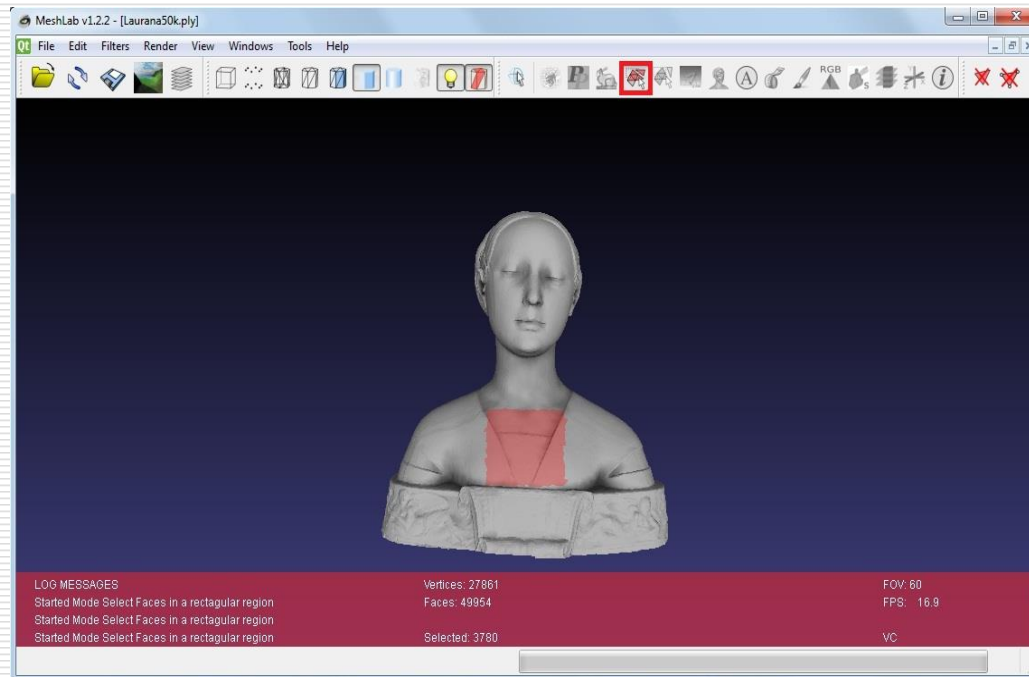




# Selection (1)

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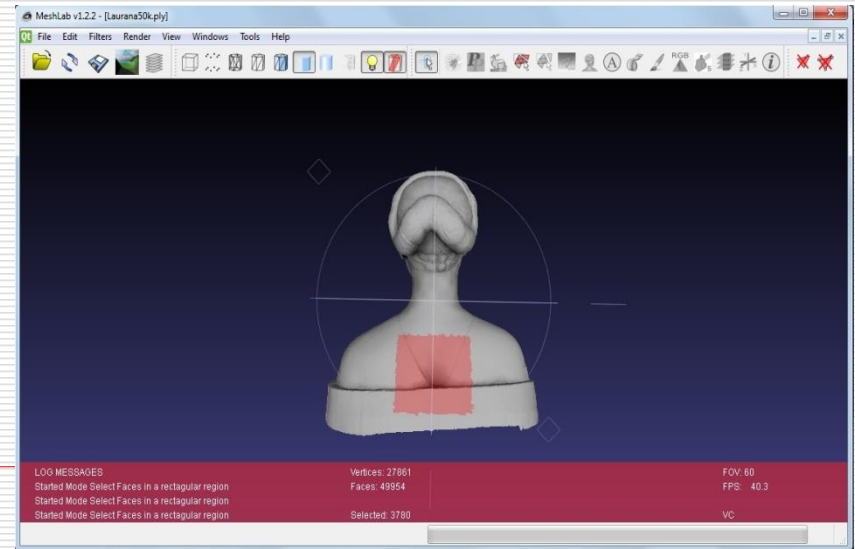
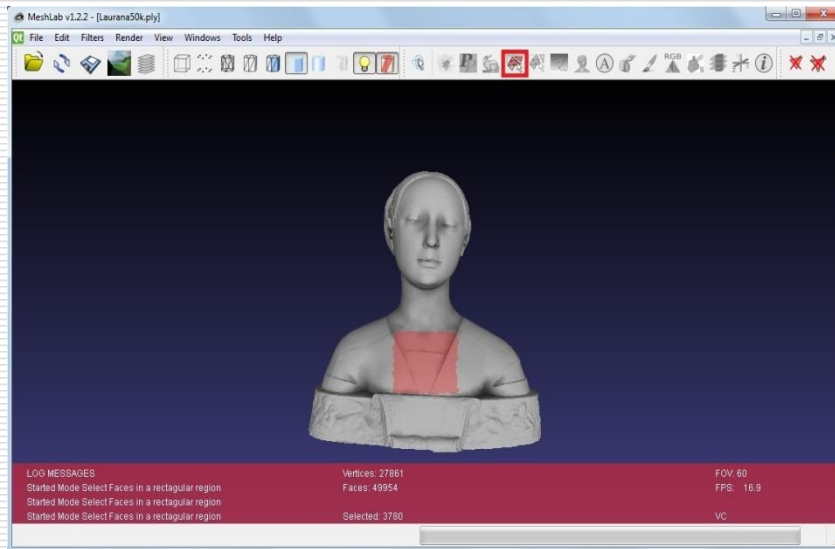
- Selection is a key operation
  - remove useless/"wrong" geometry



# 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>



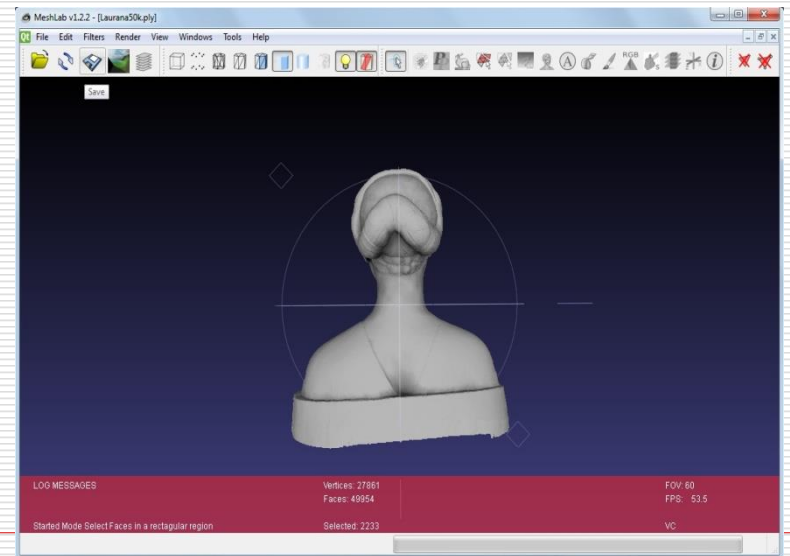
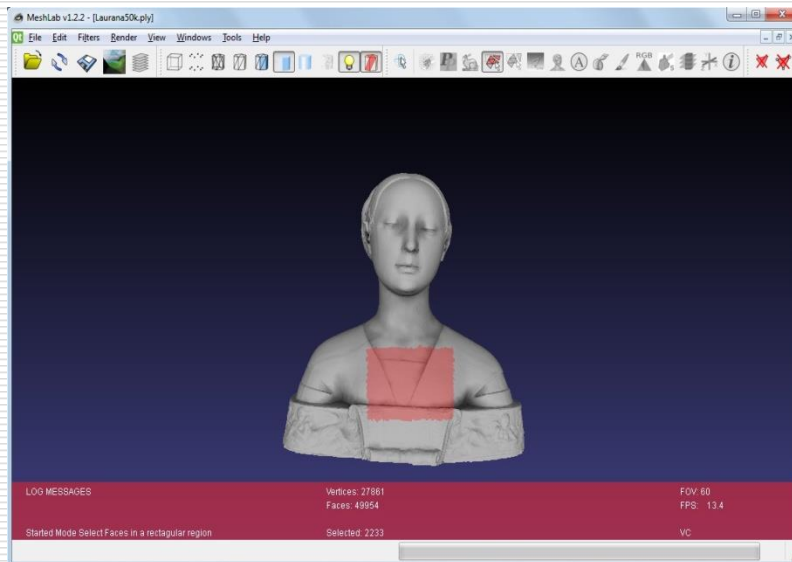
# Selection (3)

---

□ But there are other possibilities

□ Tutorial:

<https://www.youtube.com/watch?v=Bc3GdJ6Ddsc&index=12&list=PL8B1E816EAE236B4D>



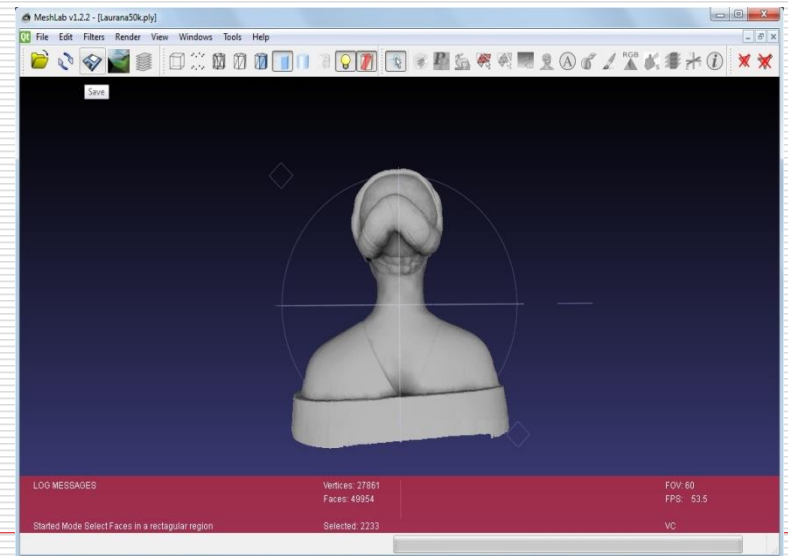
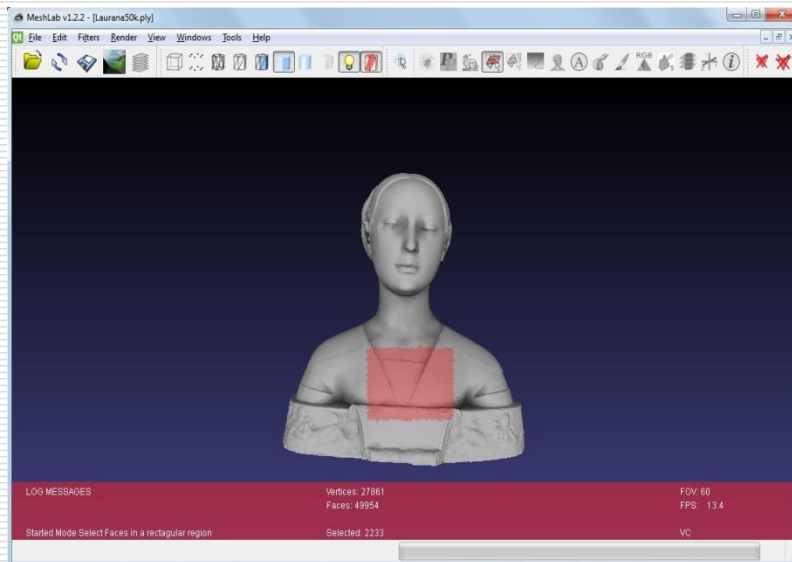
# Selection (4)

---

□ And points are handled as well


□ Tutorial:

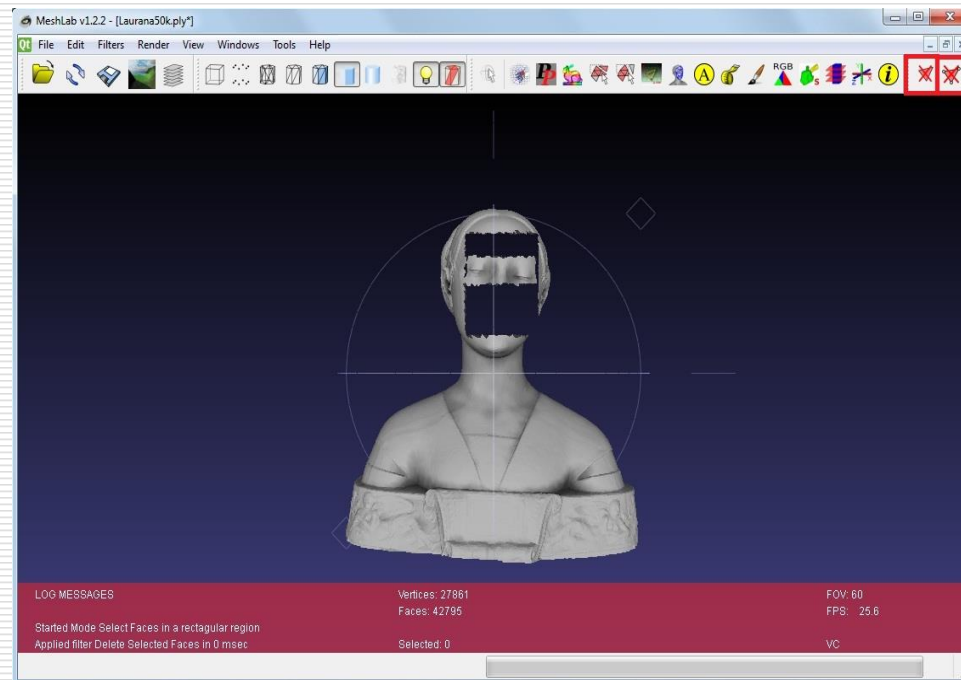
<https://www.youtube.com/watch?v=Q025ayjgD5I&index=22&list=PL8B1E816EAE236B4D>



# Delete Faces and/or Vertices

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

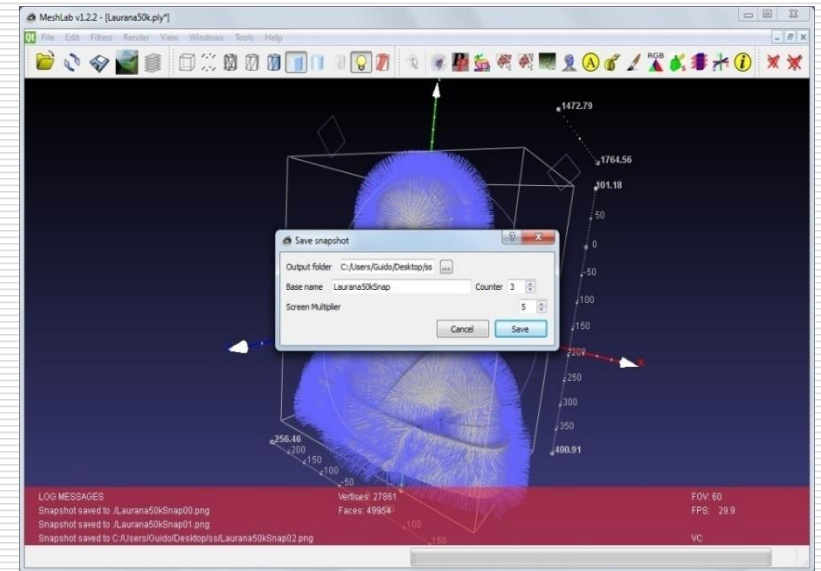
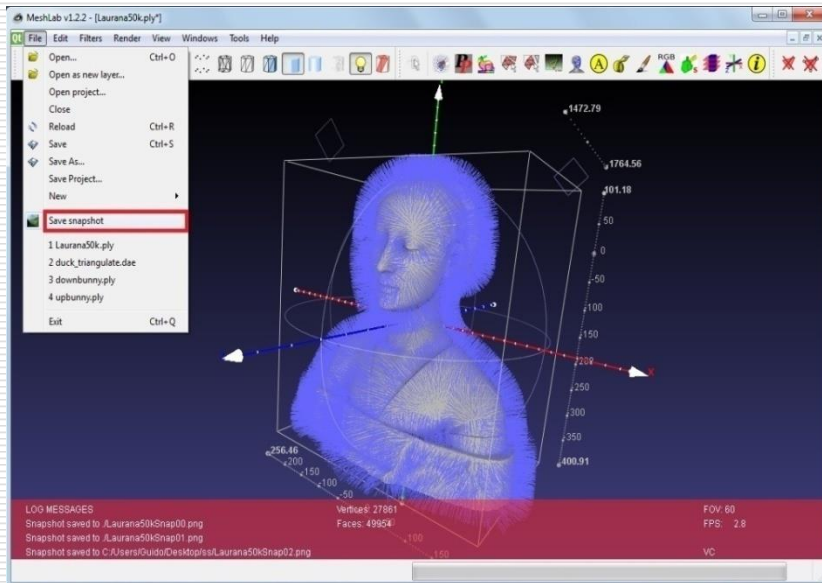


# SnapShots

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

Videotutorial:

<http://www.youtube.com/watch?v=wIOIfue-iiU&list=PL8B1E816EAE236B4D&index=7>



# Filters and Filters' Prerequisite



# Filters

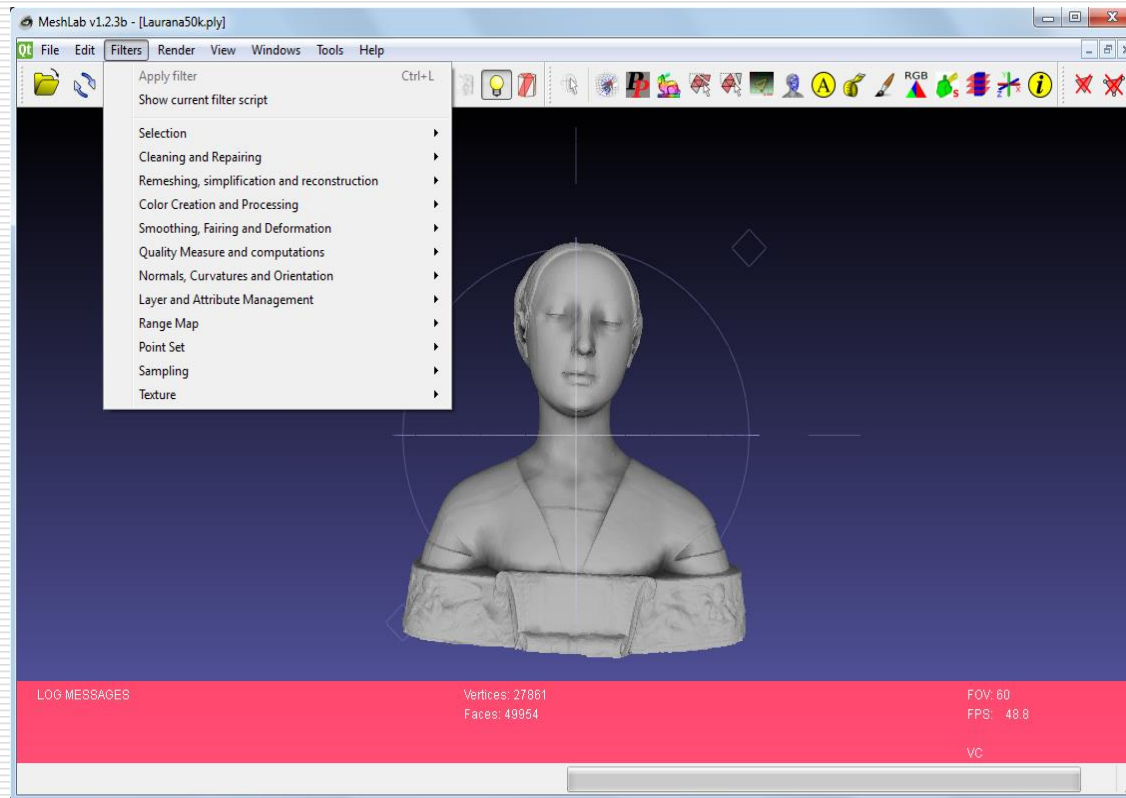
---

- 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

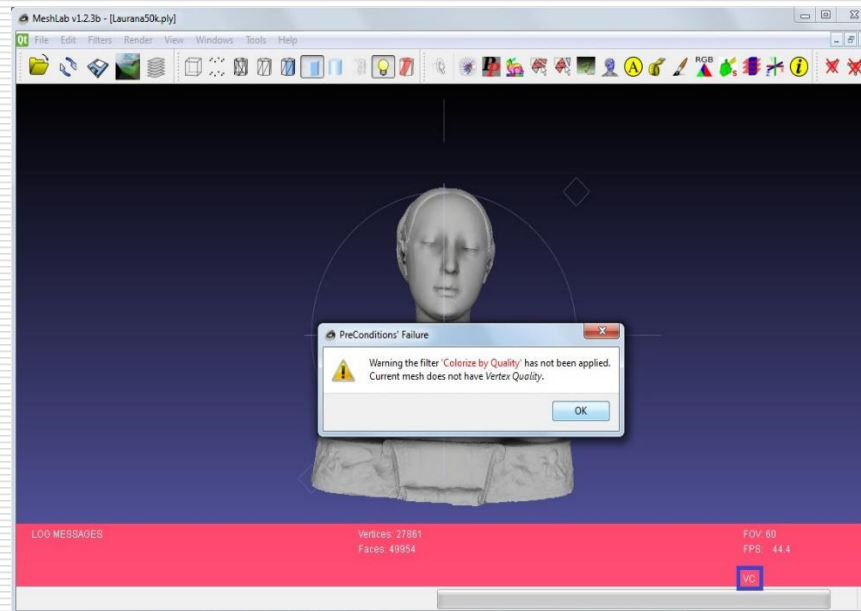
## □ Filters Menu



# 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



# Next in line...

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Next lesson:

- MeshLab mesh processing

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Personal website: <http://vcg.isti.cnr.it/~dellepiane/>

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

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