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S3: Step-by-step-guide using Blender in the work flow. V.2

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Protocol status: Working
We use this protocol and it's working

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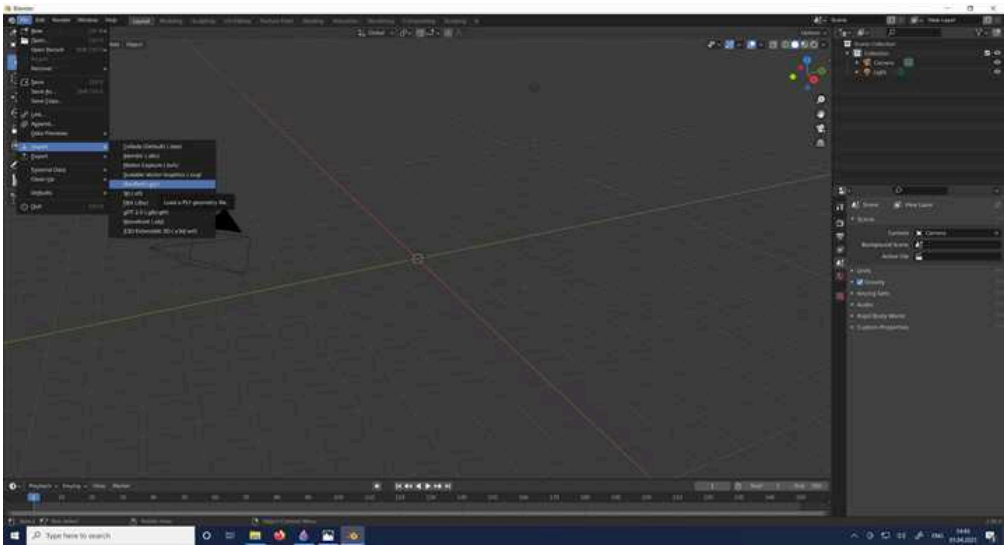
Abstract

Step-by-step-guide how to use Blender to analyse and visualize your segmented structures, for example exporting it as a video as mp4-file.

Troubleshooting

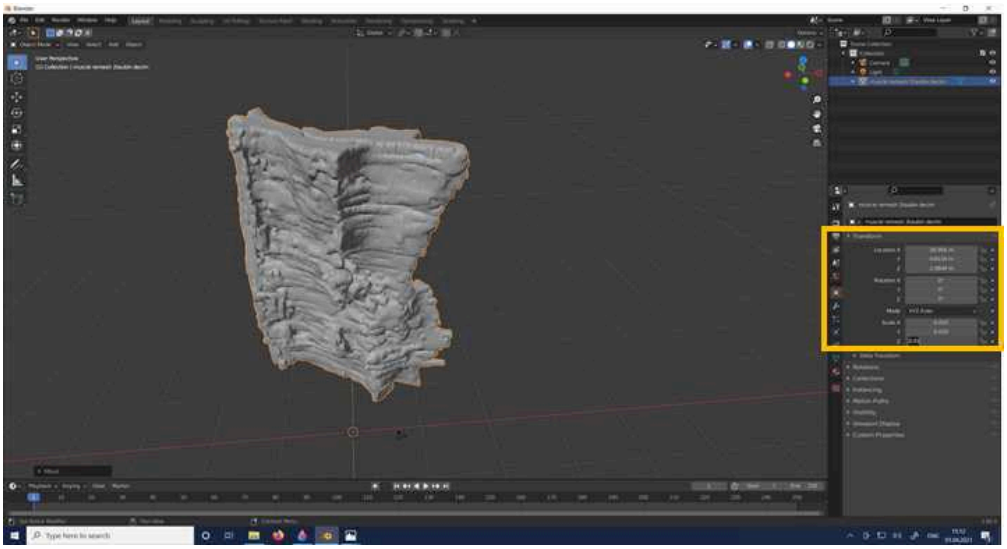
1



•Open Blender
•Choose under *New File – General*
•Delete the cube
•Now go to *File – Import-Stanford* (.ply)

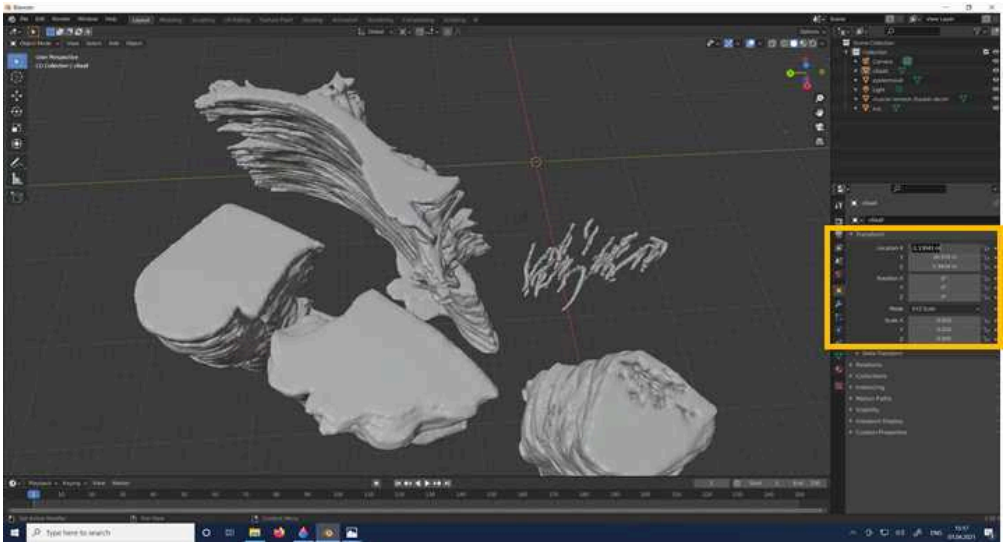
2 Moving in Blender and Hotkeys → https://www.youtube.com/watch?v=TPrnSACiTJ4

3



•Your object/mesh is very large in Blender, change under *Object Properties* the Scale of X, Y and Z from 1 to 0.01

4



•now import all your objects into Blender the same way
•you can put them everywherspace, **BUT** change the Loe in the working cation of X,Y and Z to 0 before you save

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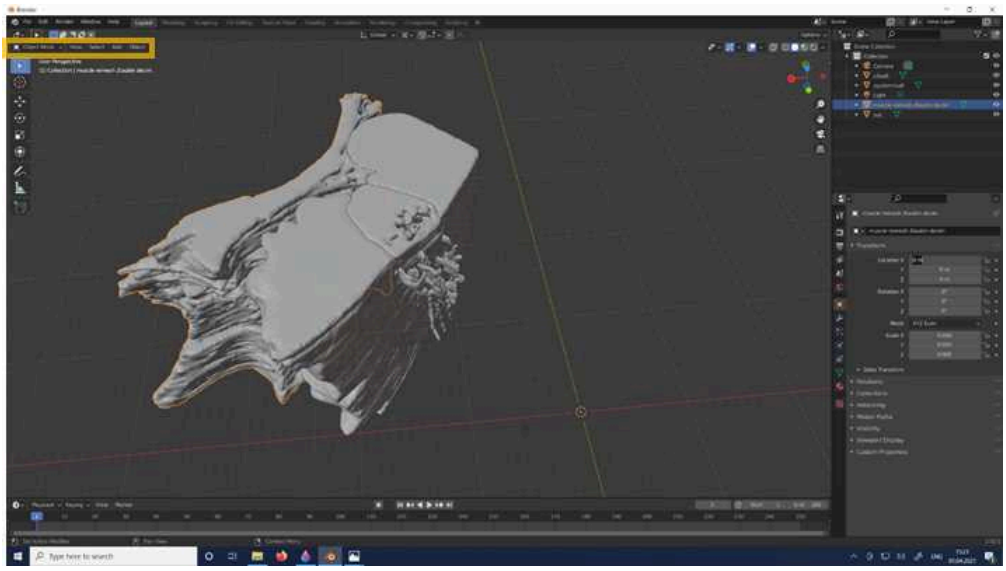

•otherwise it is nearly impossible to get them together properly, start again if that happened to you
•save now everything as Blender-file

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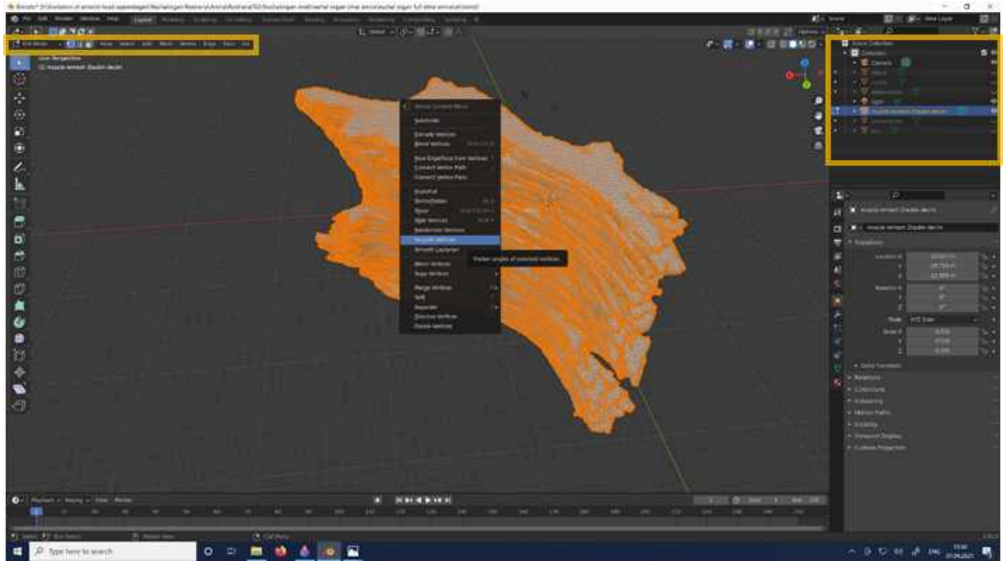

•to manipulate objects properly close all objects instead of one in the *Scene Collection* on the top right window
•if you want to smooth your whole object change from *Object Mode* to the *Edit Mode* (top left corner) and *Select all* – HotKey: A
•Right mouse button (r mb) – *Smooth Vertices*, this can be repeated multiple times

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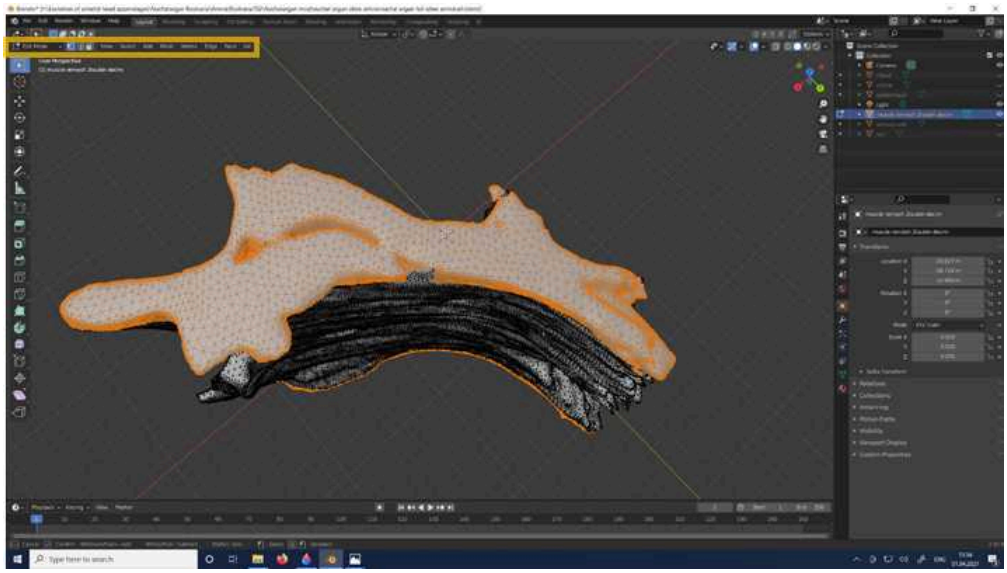
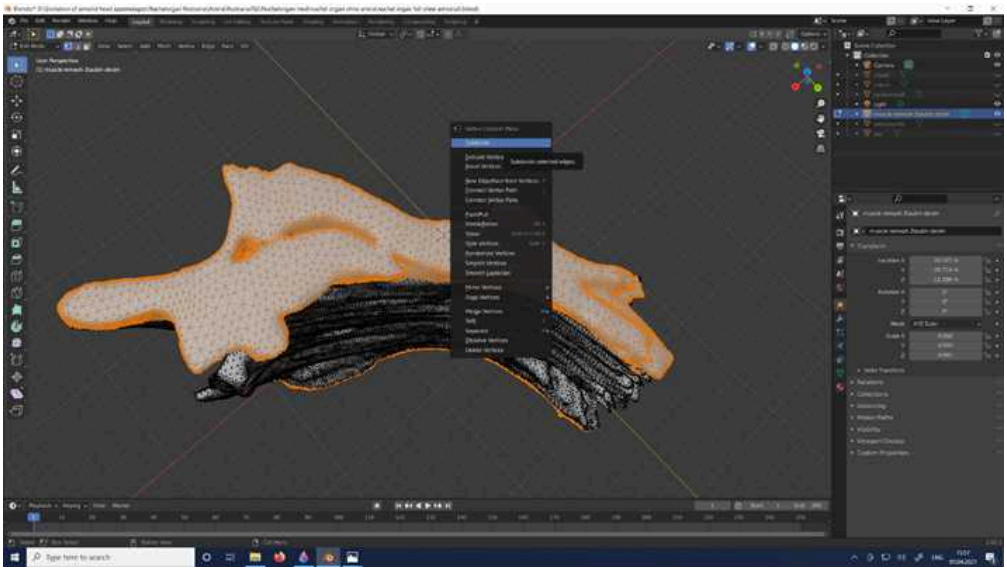


•if you plan to sculpture your mesh it is necessary to increase the number of verticies again, at least locally
•in *Edit Mode* choose *Circle select* (Hotkey: C) under Select

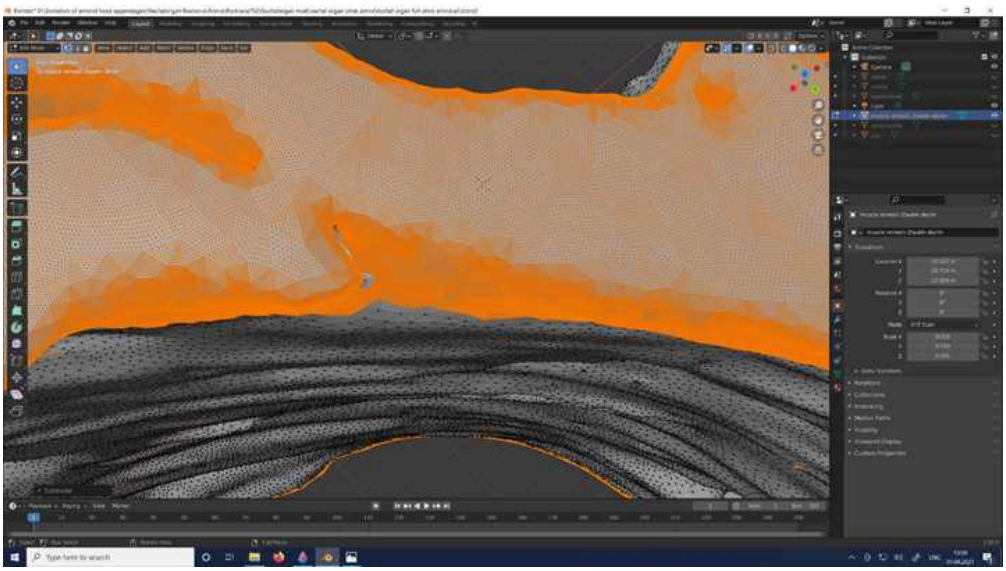
•now you can select with the Left mouse button (l mb) or erase selection by pressing the mouse wheel (mw)

8



•if you are happy with your selection press r mb – *Subdivide*
•this step can be repeated multiple times

9



•as a result you get a local multiplication of vertices you can manipulate in the next step
•**Use as few as possible Vertices for your project!**

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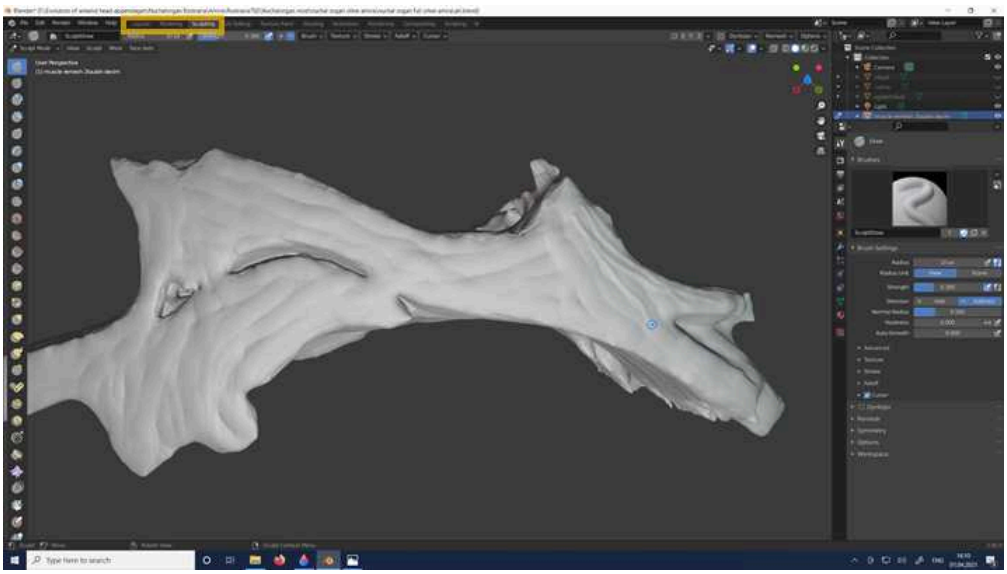

•Change from *Layout* to *Sculpting* to give your surface the structure you want:
-In this case we exemplarily used the original data as a template and added muscle fibers
•If you want to cut your objects later check for overlapping surfaces → it might be difficult to make bigger adjustments later (see *Boolean Modifier*, Cutting)

→ Also see: https://www.youtube.com/watch?v=VYuUlQO-kYE

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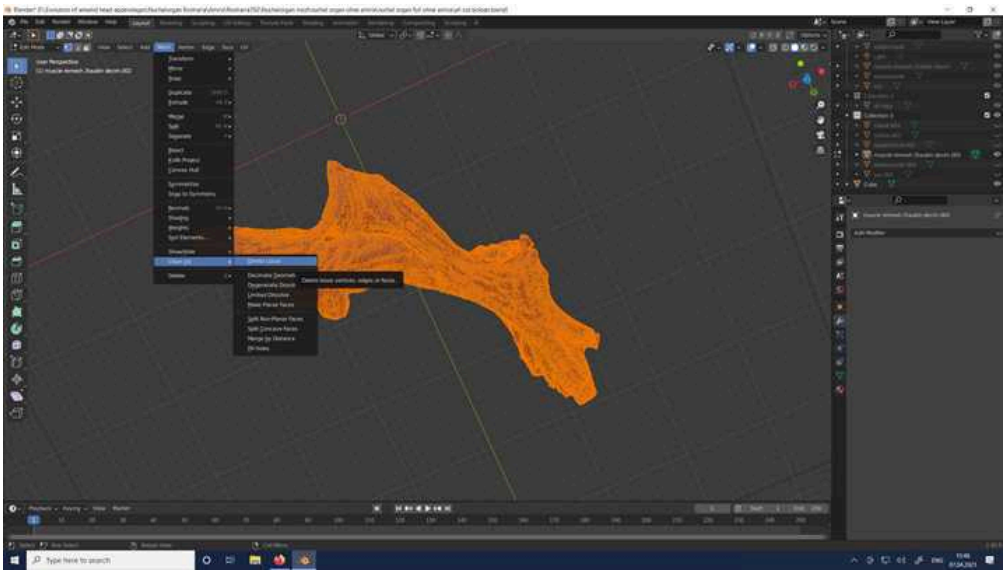

•Now it is possible to clean up the meshes of your objects
•Change to *Edit Mode*, go to *Mesh-Clean Up-Delete Loose*

→ Which delete loose vertices, edges and faces

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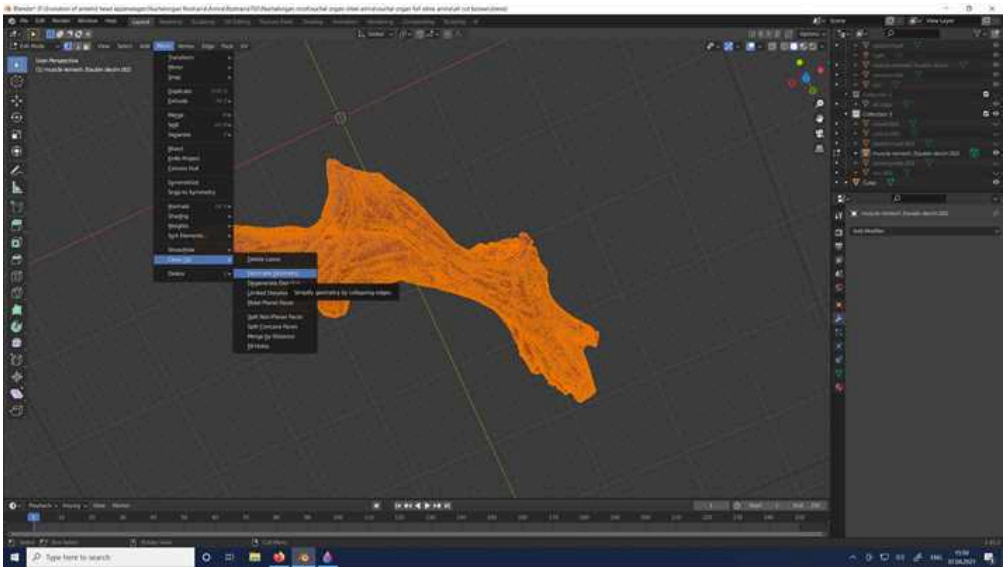

•Now go to ...- *Decimate Geometry* and simplify your mesh again

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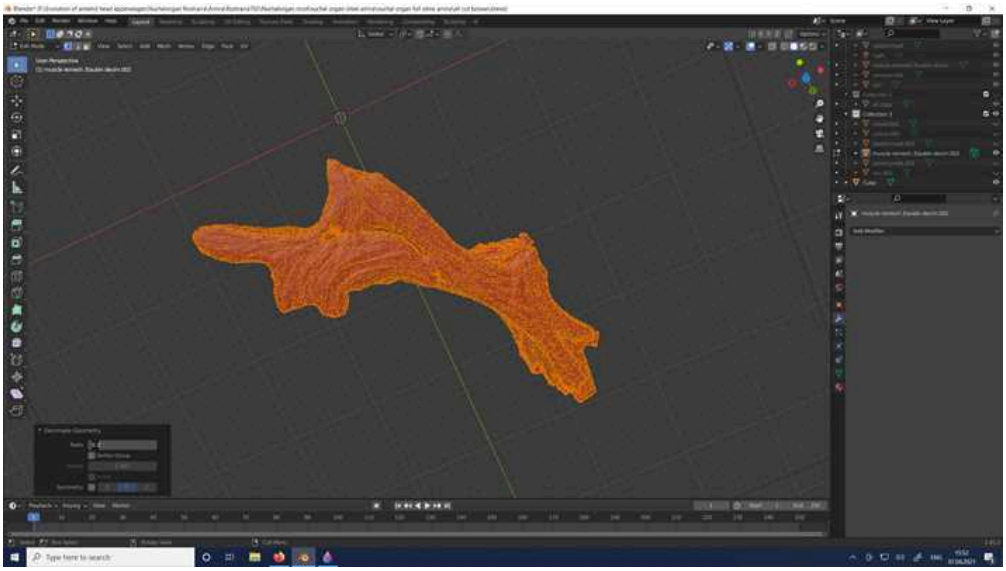

•Choose a ratio for the simplification
-In the example the number of vertices is highly decreased

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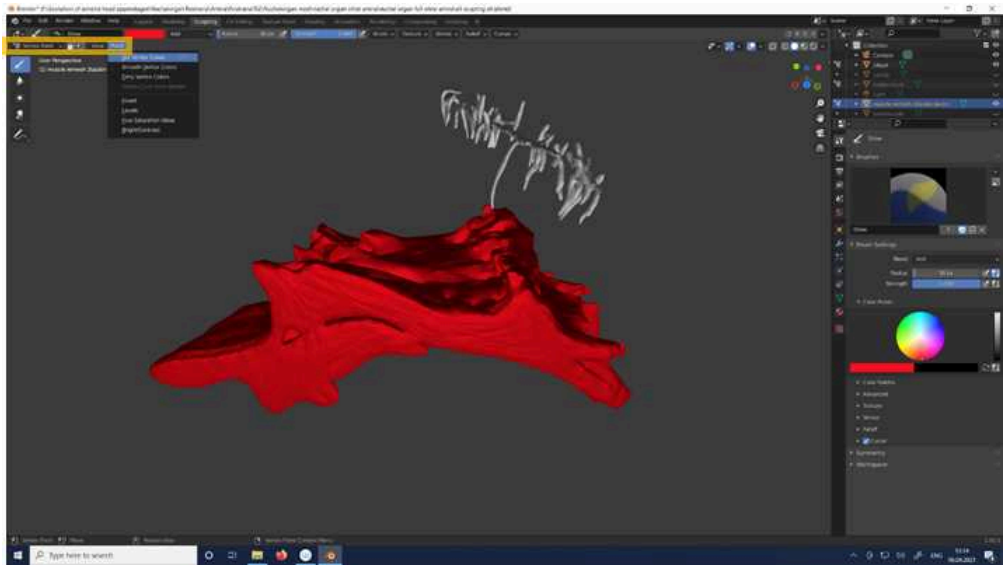

•If you want to colour your object individually by painting patterns, camouflage etc. ... you can change from *Object Mode* to *Vertex Paint*
•When you use *Workbench* as Render Engine (*Render Properties*) your individual coloration will be kept for Render

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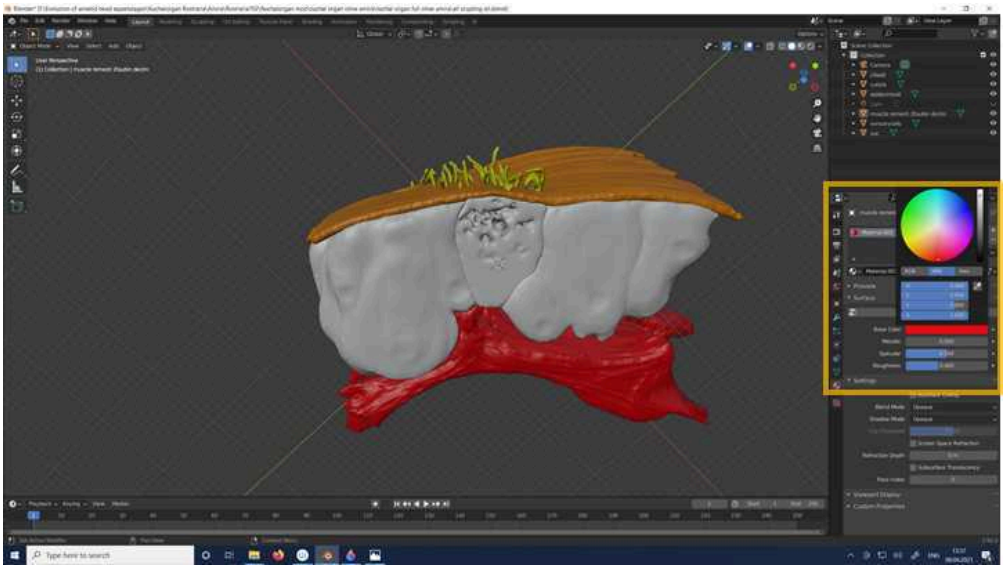

•If you like to colouryour objects in consistent colours change to *Object Mode* and choose your respective colour under *Material properties*
•Don´t use *Use Nodes* for that (*Workbench*)
•If you use *Workbench* as Render Engine the coloration will be kept that way
•If you want to use *Eevee or Cycles* you have a lot more to configure

•You can check the appearance of your objects in the Render by choosing the *Viewport Shading* (left to the Scene collection)- *Display render preview*

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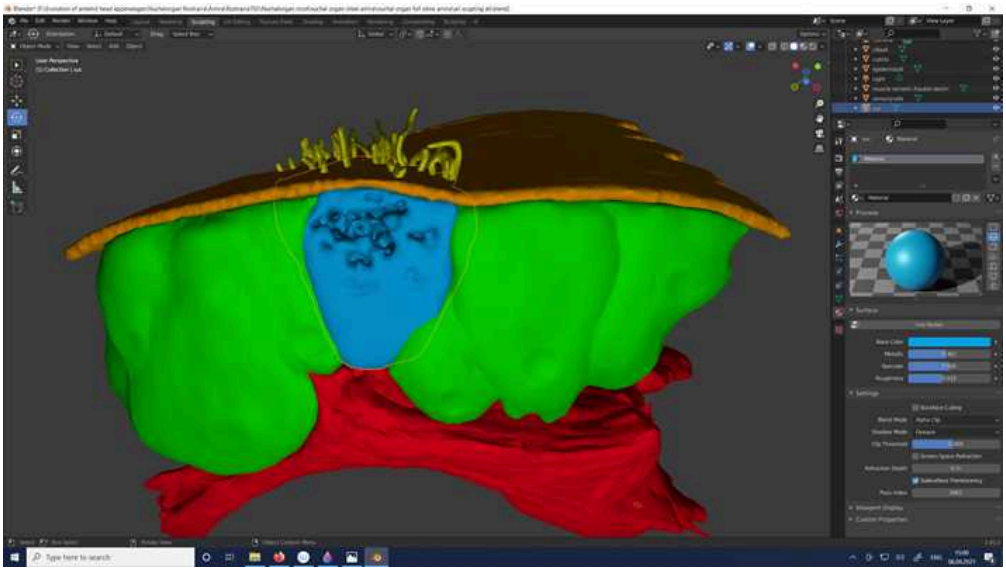

•Now every object is coloured

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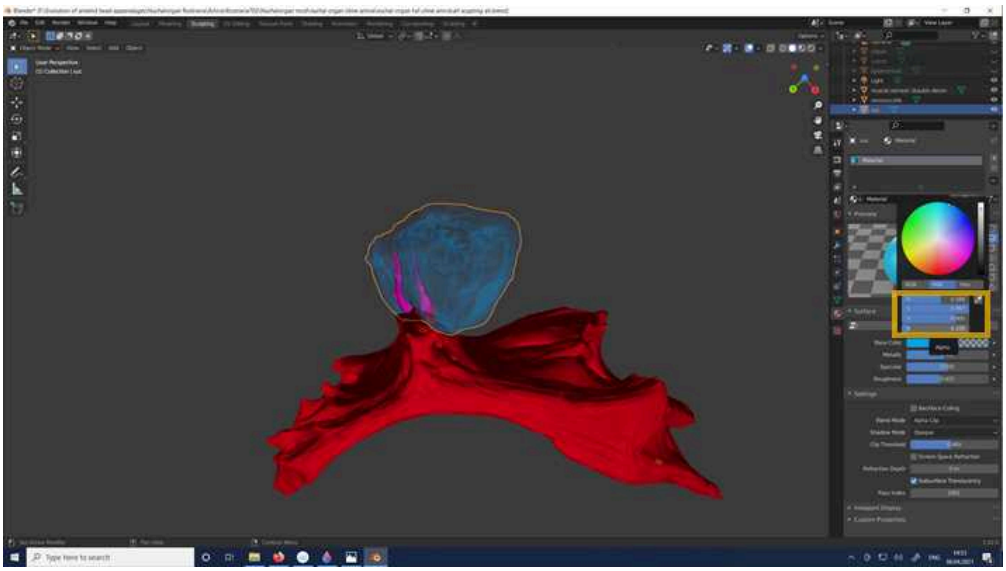

•You can also change *alpha* to show a structure more transparent (in our example the so called "olfactory chamber" of the amphinomidnuchal organ)

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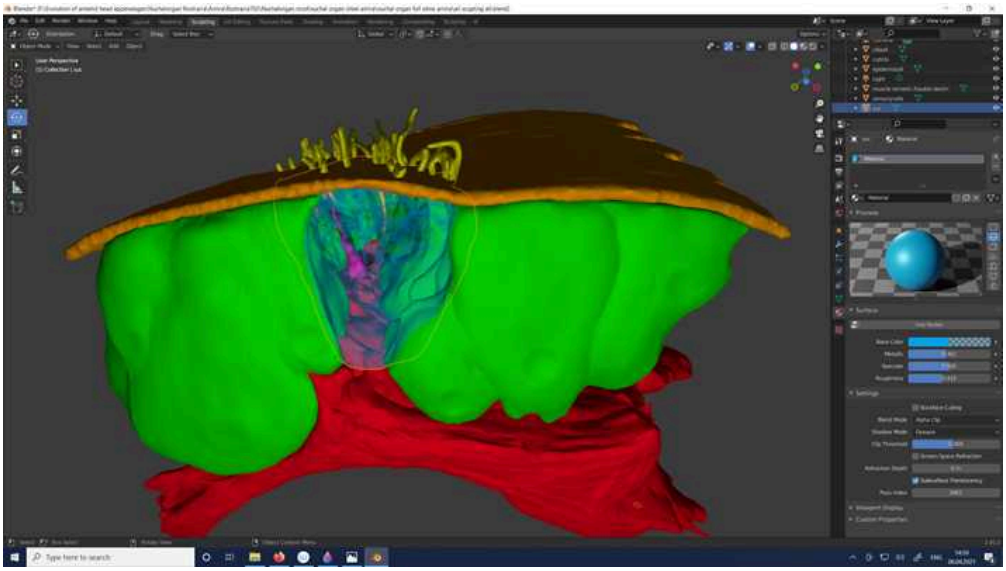

•As a result you can see the “sensory cells” (pink) inside the “olfactory chamber” (blue)

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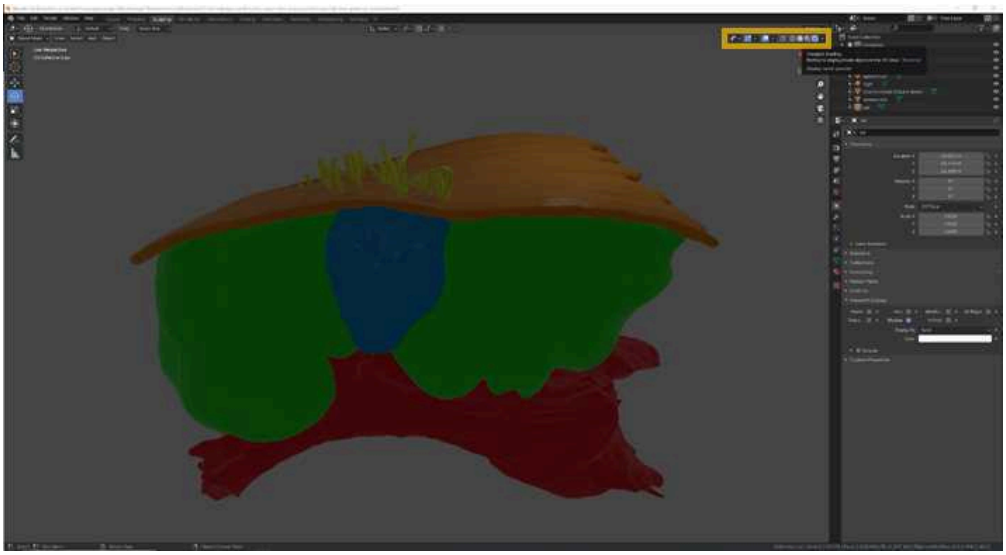

•As Render Engine *Eevee* is default
•If you change *Viewport Shading* to *Display render preview* it looks like shown here

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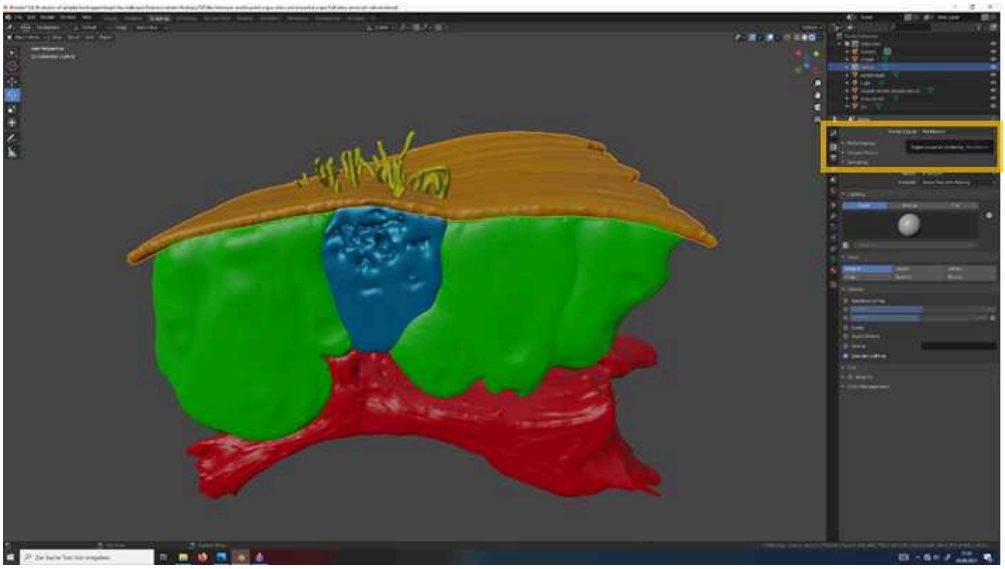

•Go into *Scene Collection* to *Render Properties* and change to *Workbench*

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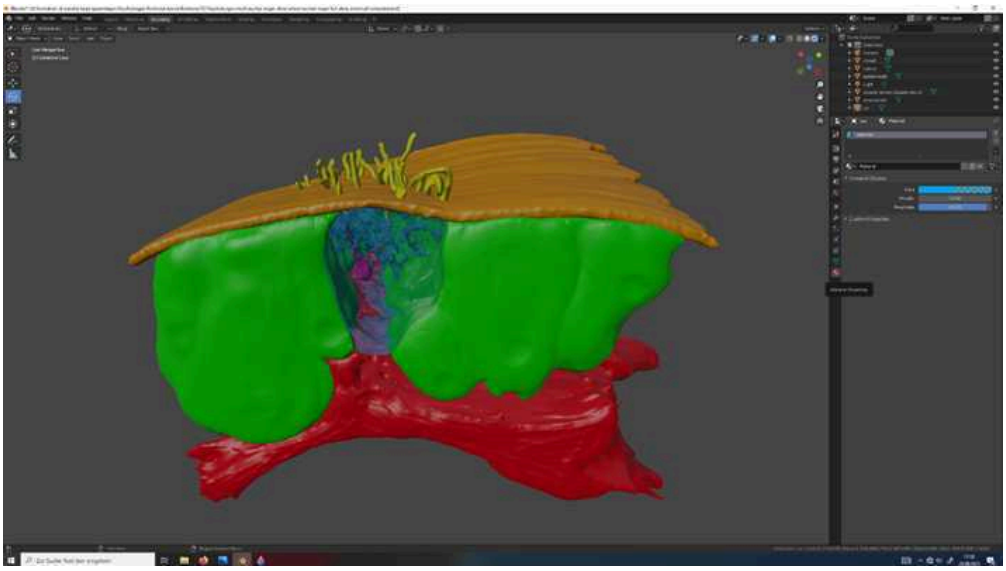

•It might happen you have to adjust the alpha again under *Material Properties*

22 •Now our structure of interest (here the nuchal organ) is coloured, sculptured and ready for animation

-In this example we used modifications of what we think this workflow should provide

→ Finally we want to show how to do a rotating video of the nuchal organ of Paramphinome sp.

→ In this video we want to show the entire nuchal organ and a cutted version of it, to get abetter view of the internal morphology

→ Therefore we have to arrange the scene

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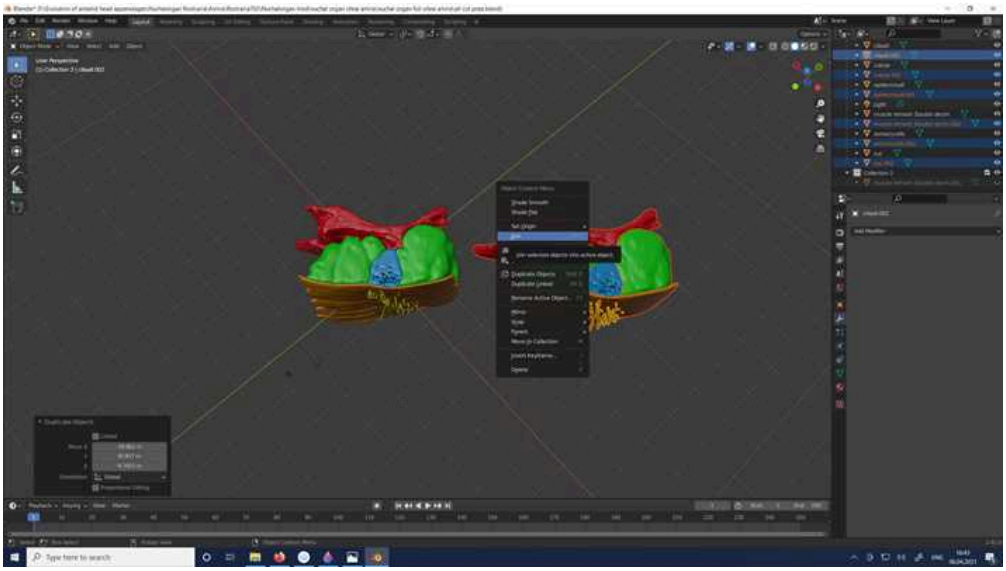

•To duplicate your objects go to *Edit Mod*e and select all
•R mb – *Duplicate objects* or Hotkey shift+D
•The object/s now follow your courser till you click the l mb
•R mb – Join or Hotekey ctrl + J

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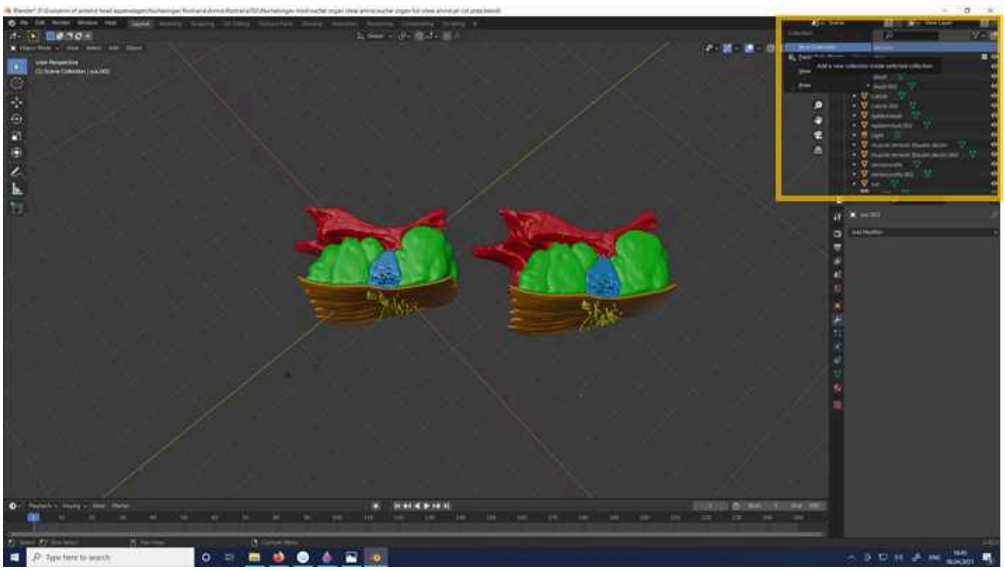

•Now you have a second but joined version of the structure of interest
•Go to the top right window Scene Collection and add a *new Collection*

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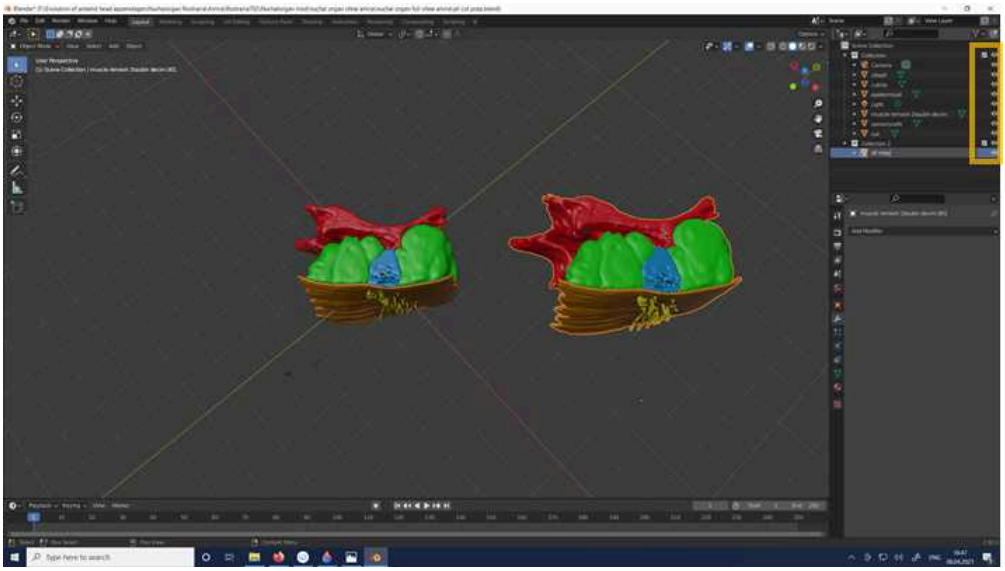

•Rename your joined objects inside the *new collection* (Collection 2)
•For the recording we put the joined and the unjoined (later cut) version of the nuchal organ at the exact same position
•You can make each Collection or object *visible* or *invisible* by checking or unchecking the eye button in the Scene Collection

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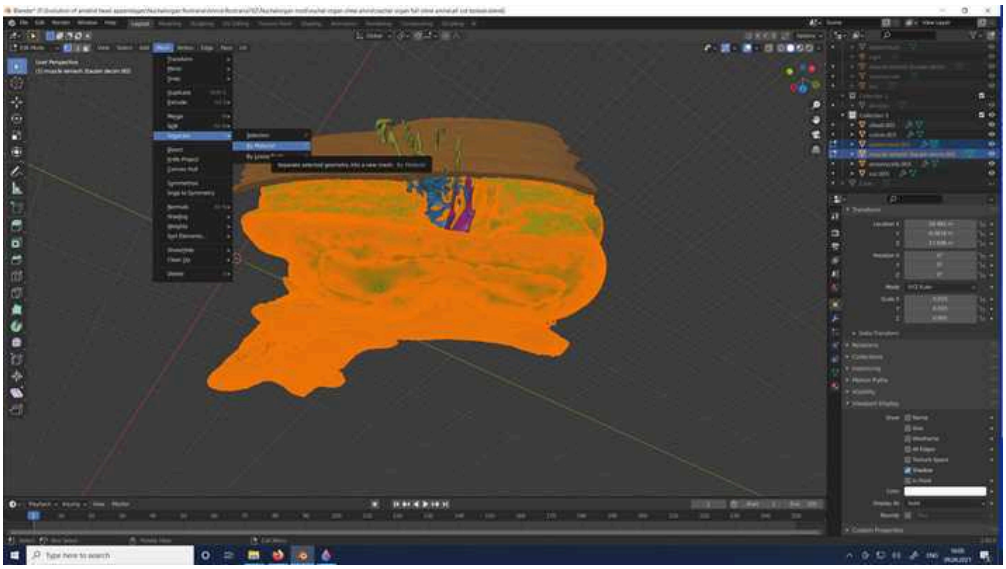

→ For the next step, the cutting of the nuchal organ in half it might be helpful to do the following steps as a preparation
•In *Edit Mode* select two meshes and go to *Mesh-Separate-By Material*

→ You can repeat it for all meshes or just select all of them in ones, but it makes it slightly more chaotic

•If you choose*...-by Loose Parts* all not connected parts of your mesh will be listed seperately in the *Scene Collection*, an easy way to get rid of loose parts/vertices or faces in your objects/meshes

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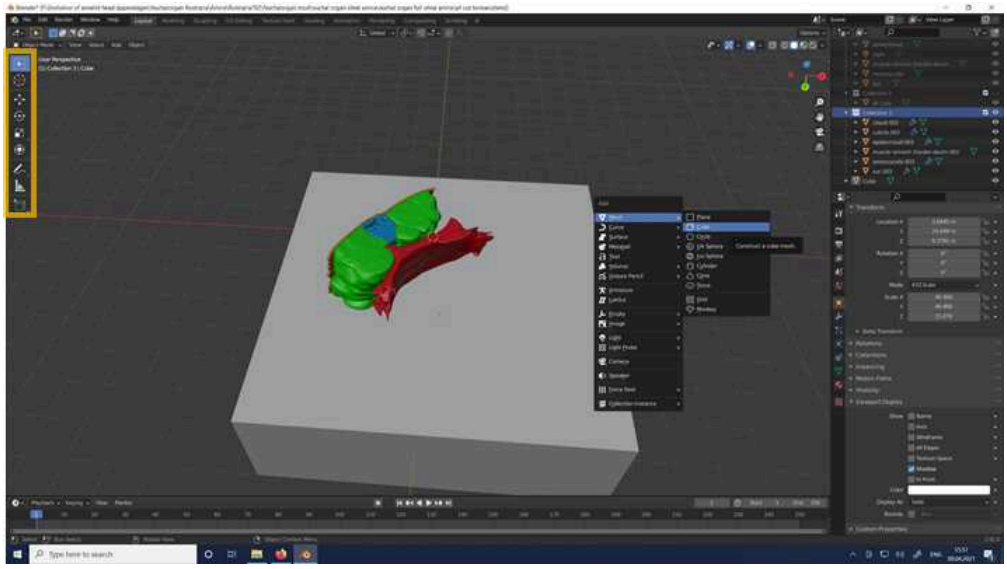

•In *Object Mode* go to –*Mesh-Cube* or Hotkey: shift+A and create a cube

•Scale the cube by click on the left vertical bar *Scale*, pull the green, blue or red handle as you need it or Hotkey: S+X,Yor Z and move the mouse

→The cube should be thicker than the half of the object you want to cut and longer and wider than the whole object, we will use the cube to define the area of your object which will get cut

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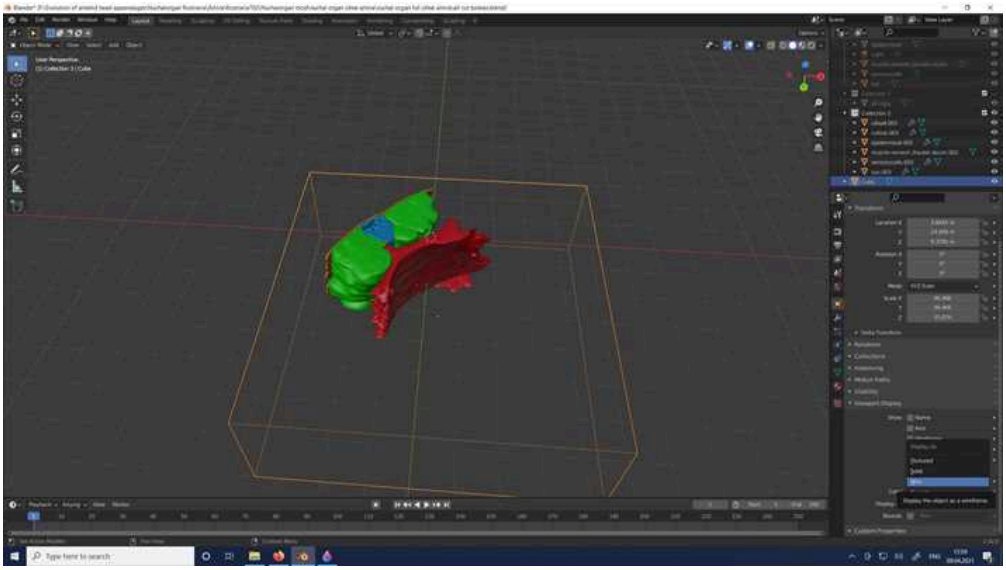

•Select the cube and check under *Object Properties-Viewport Display-Display as-Wire*
→ Now your cube is transparent and you can see if the cutting works

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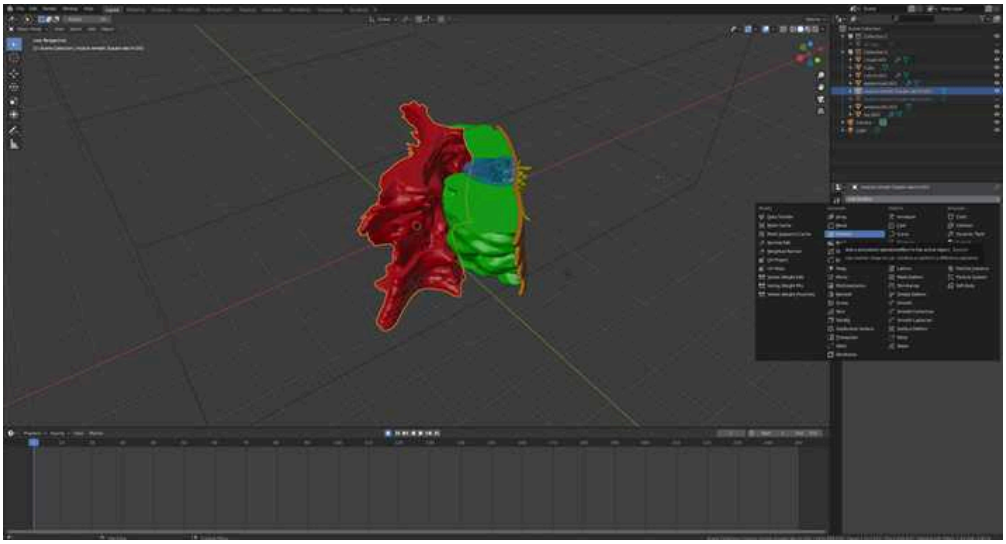

•We use the *Boolean Modifier* to subtract an area from our object using the cube
•Select one of your objects, go to *Modifier Properties* (right side under Scene Collecion)-*Add Modifier-Boolean* (Generate)

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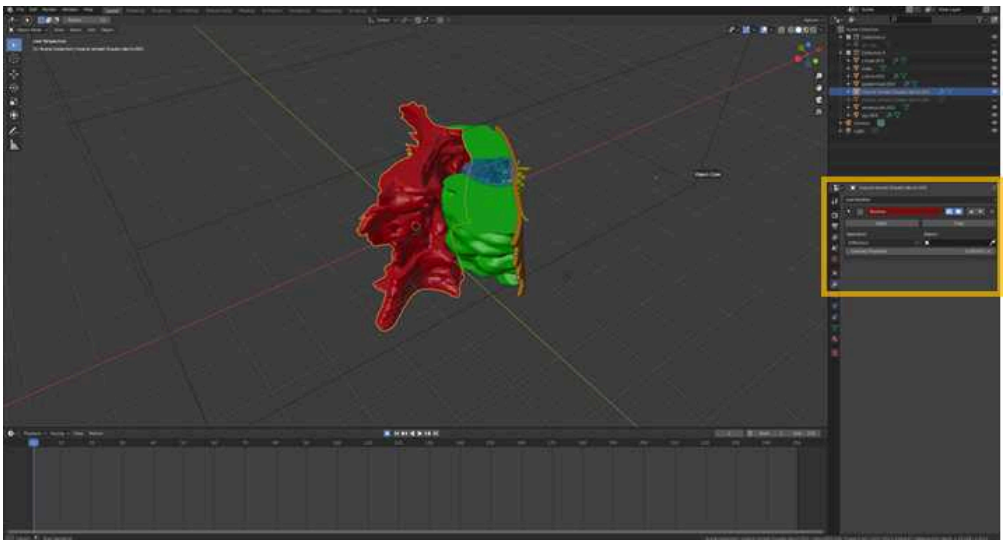

•Choose *Difference* as Operation if it is not by default
•Click on the pipette and click with the pipette on the cube

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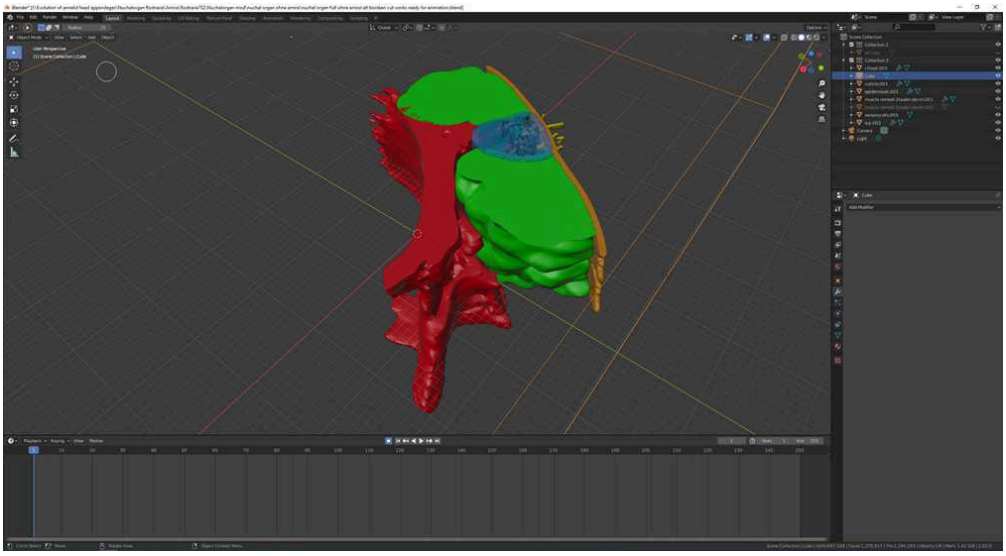

•After repeating it for all objects which are part of you animation it looks like shown
•If it does not work for the Z-plane you want to cut, try to move the cube in Z-direction
•If your computer gets too slow, delete the modifier, move the cube and start again
•At the boarders of the different objects you see artefacts because of surfaces overlaps
•You can select one of the overlapping surfaces and go to *Edit Mode-Mesh-Transform-e.g. Shrink/Fatten,*
•..-Push/Pull and other operators to reduce the area of overlap

→ Or check during the Sculpting that you do not have overlapping surface where you want to cut later

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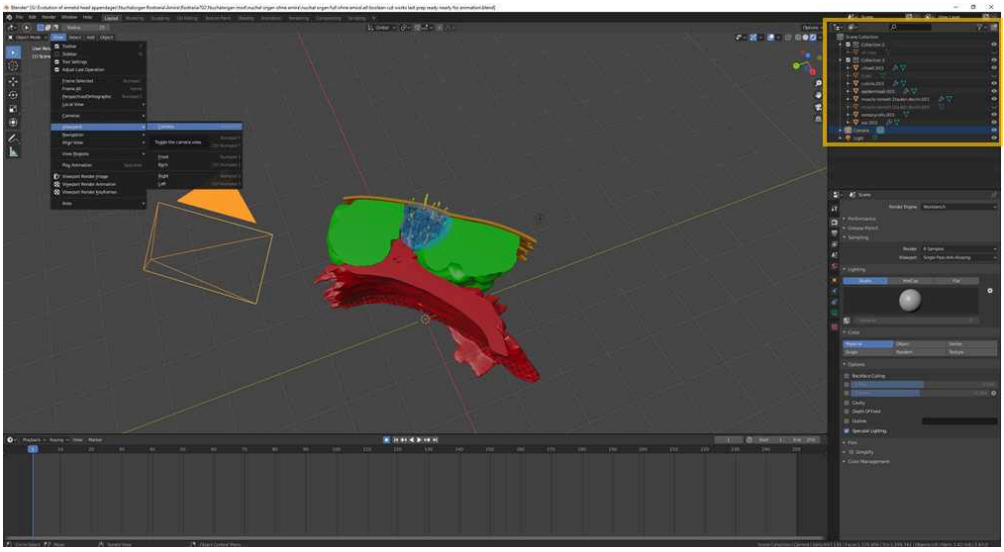

•Now it is time to plan your video or image render
•First go to *Object Mode* and select *View-Viewport-Camera* or just click on the Camera in the *Scene Collection* or Hotkey: numpad0 to have the camera view
•You can move the camera like all other objects under *Object Properties* or use the Hotkeys after selecting the camera:
-G- moving with the courser
-G+X,Y, and Z- to move it along the x-,y- or z-axis
→ The easiest way to arrange your camera at the starting point you want to is to use your actual view as a template for the camera:
•choose the perfect view
•go to *View-Align View-Align Active Camera* to View or Hotkey: Ctrl + Alt + numpad 0

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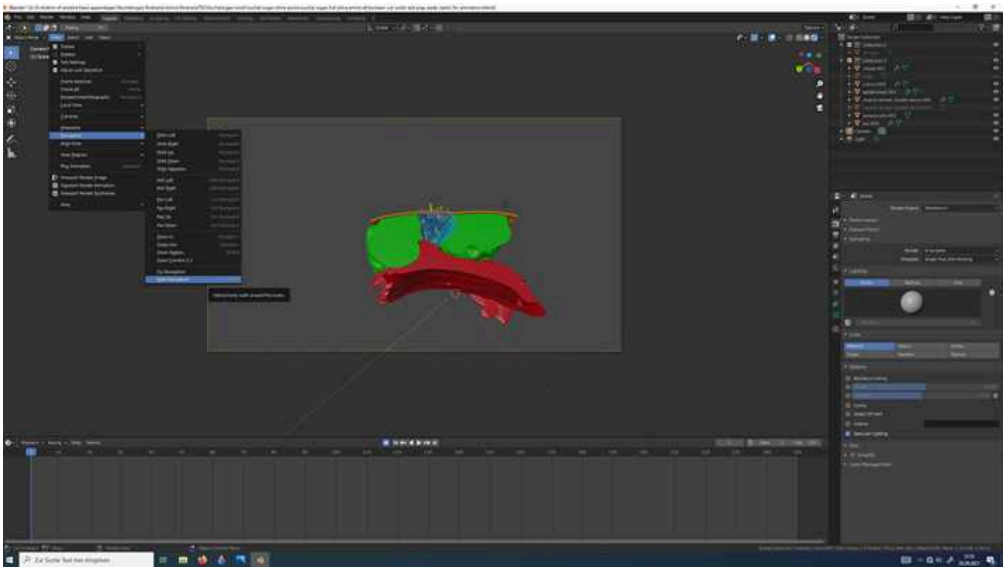

•R mb on the frame → you can change the *Camera Lens Angle*

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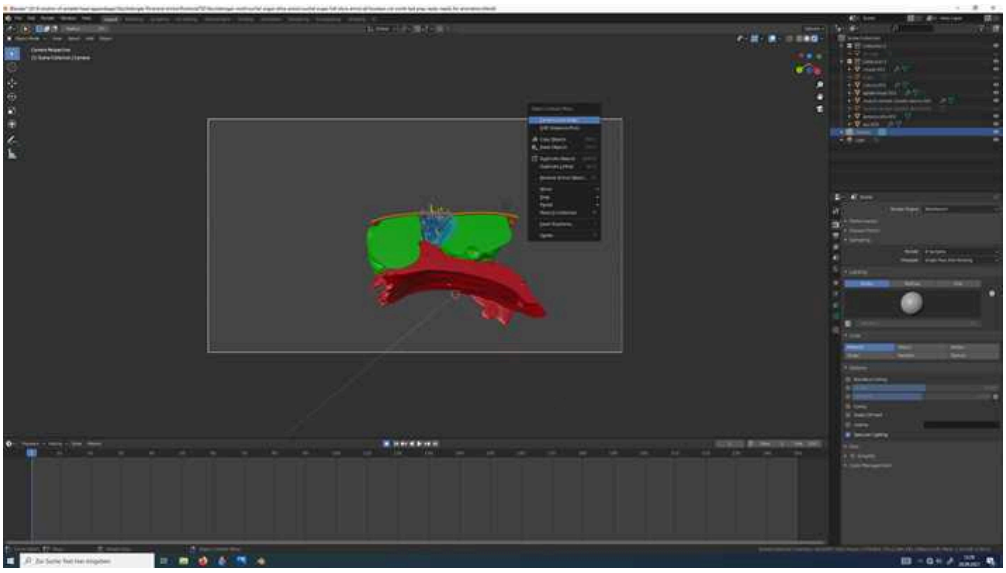

•A very powerful tool in Blender is the *Walk Navigation* to create animations fast
→ Also see: **https://www.youtube.com/watch?v=a7qyW1G350g**
•Go to *View-Navigation-Walk Navigation*, you can create an own Hotkey: e.g. shift+F by r mb on *Walk Navigation*

→ Also see: camera paths ...
https://www.youtube.com/watch?v=n2rwiz5gBnk&t=0s

https://www.youtube.com/watch?v=1byaQygtcpc

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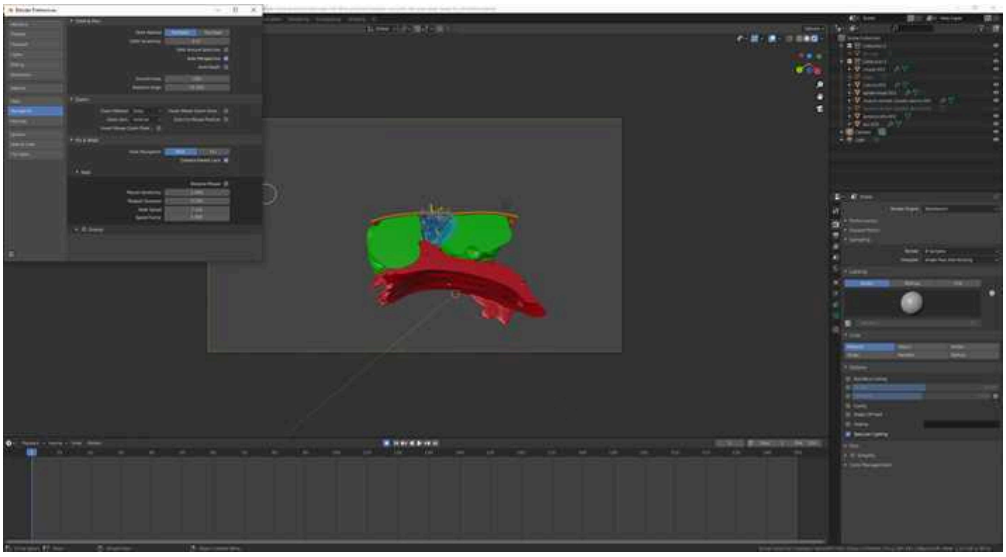

•Now change the parameters for your individual project for the *Walk Navigation* by clicking on *Edit (main toolbar)-Preferences-Navigation-Fly&Walk-Walk* and play around what is suitable for you
→ e.g. do a 360° round around your object
→ later we will smooth the camera movements, at the current state the movements are still pretty wobbly or juddery

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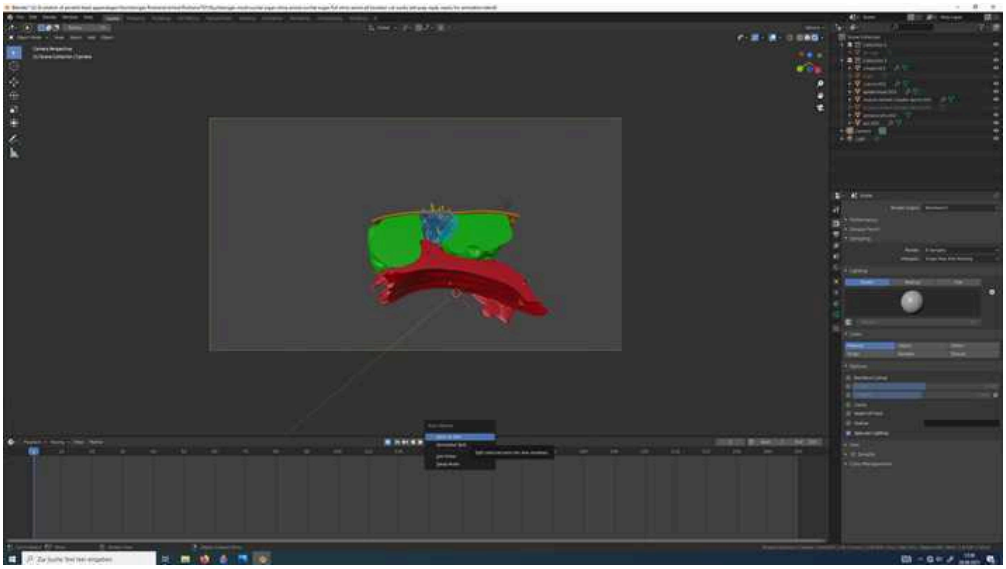

•Use a vertical split of your workspace to manipulate and smooth the camera movements

-r mb on Time Line header and click on *Vertical Split*

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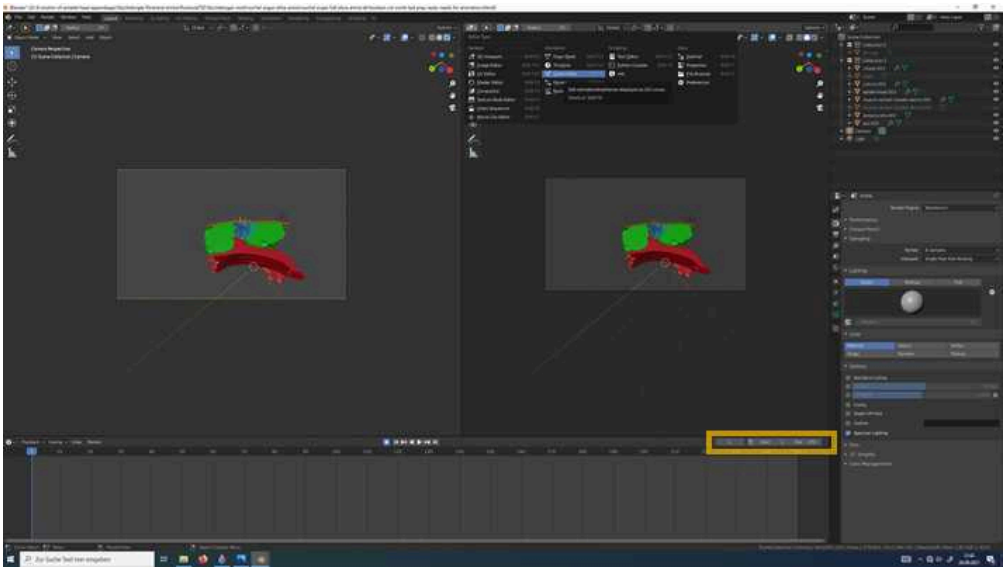

•now you have a left and a right window
•in one of them go to the top left tool bar on *Editor Type* and choose *Graph Editor* (Animation)

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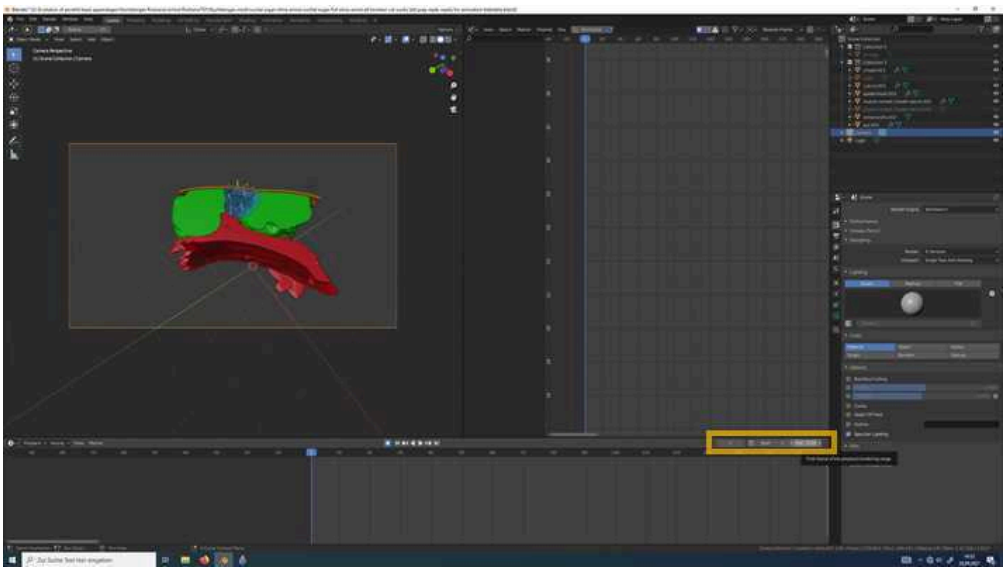

•in the Time Line set the *End frame* higher to increase the length of your animation
•at latest now you should set your camera to the point you want to start your animation as described above, you can also use the *Walk Navigation* for that

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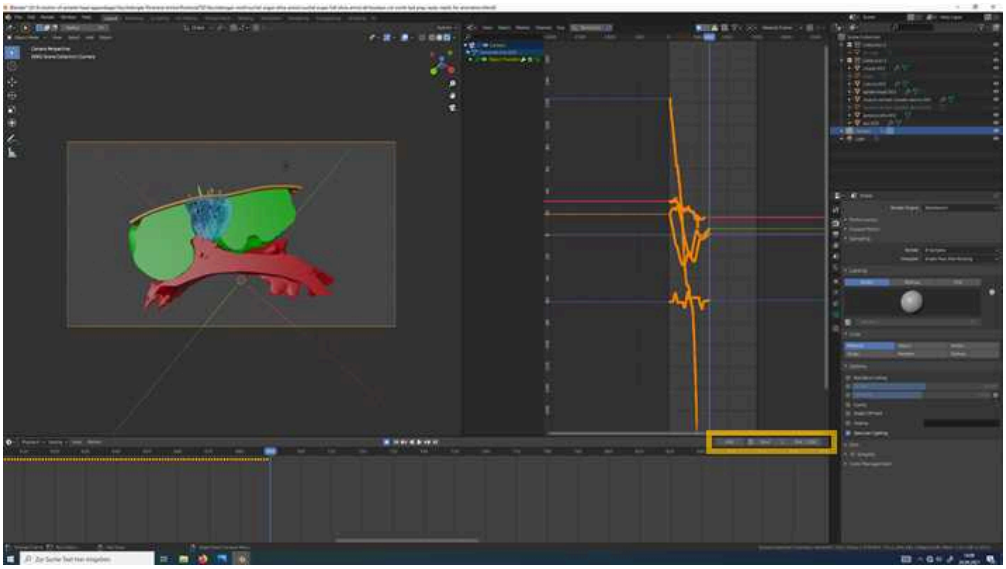

•ready to start your first recording
•activate Auto Keying the dot symbol in the Time Line
•press SPACE bar to start the recording, use the Hotkey (e.g. shift+F) to activate the Walk Navigation and move around your object
•start with a 360° circle around your structure
•l mb to stop the Walk Navigation and space bar for stopping the recording

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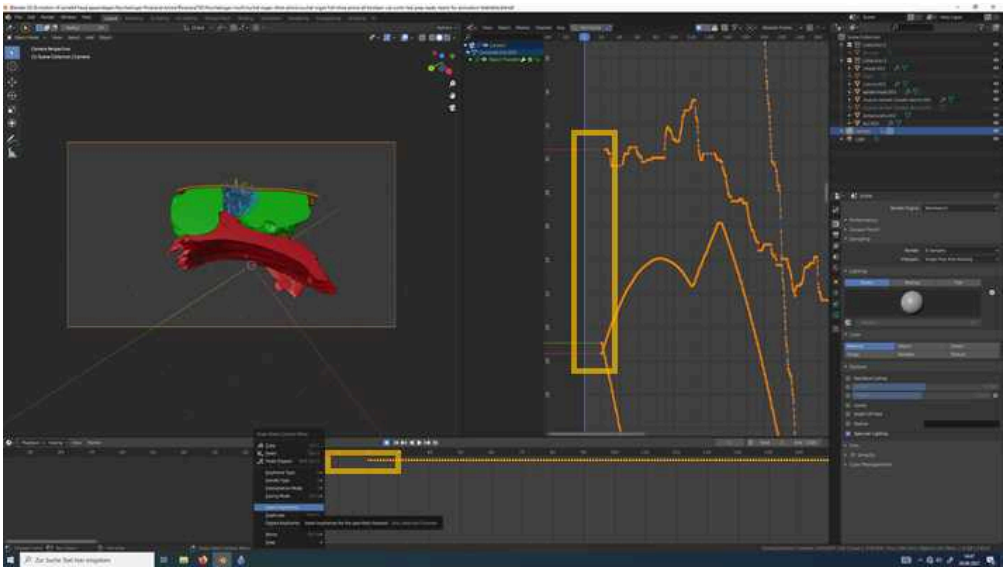

•now you see *Keyframes* in the Time Line and the *Graph Editor*
•click on *Jump to Endpoint* in the direction of the start (left) in the Time Line

•at the beginning of your recording Keyframes are missing, add one at the beginning (frame 0) by r mb – *Insert Keyframes* or press I and press the enter key for *All Channels* or *Only Selected Channels*

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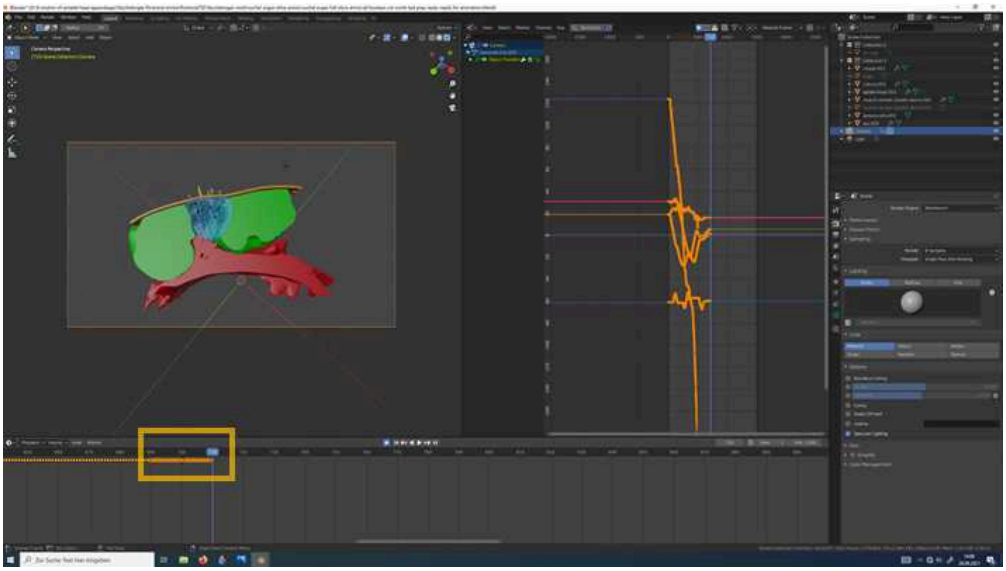
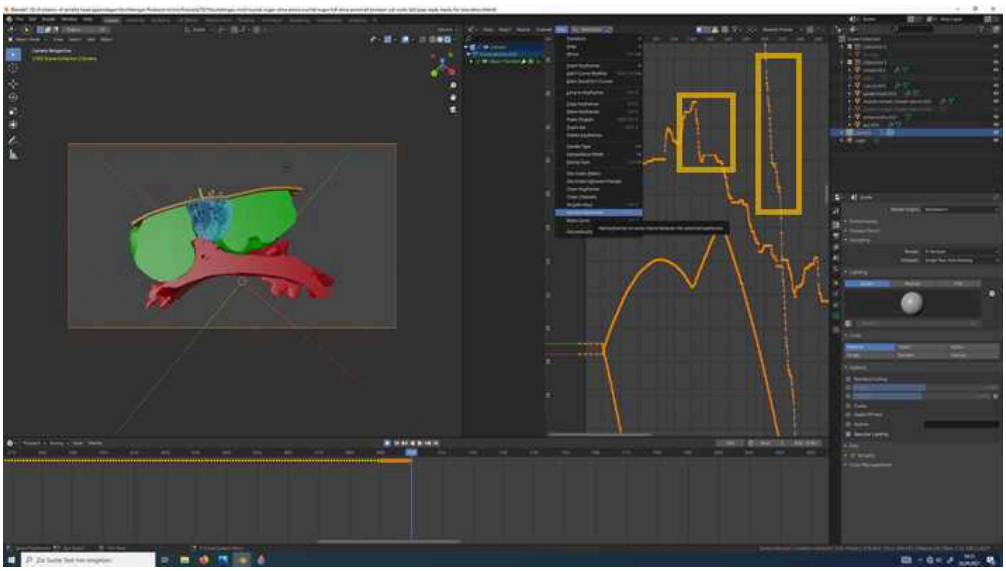


•do the same for the last frame you want to have in your animation

42



•take a look on your recording by clicking on the *Play Animation button* in the Time Line → it will be pretty woobly, now we want to make it smooth
•first we insert Keyframeswere no Keyframes are
•if you zoom into the Graph Editor you see in the lines free spots

•in the right window next to Editor Type click on *Keys-Sample Keyframes* or Hotkey: shift+Alt+O

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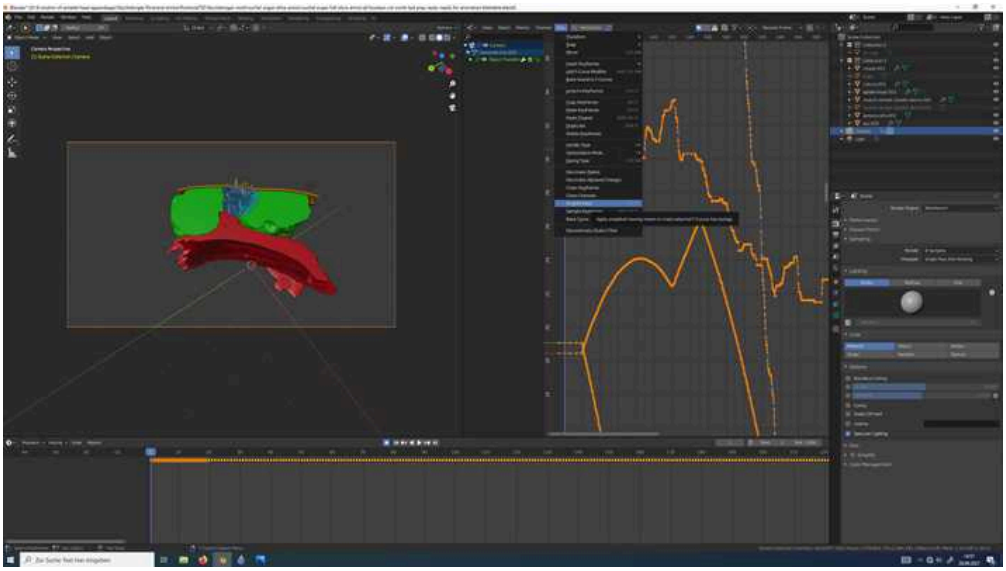

•now we have filled the gaps with Keyframes and can smooth the graphs of the camera movements

•click on K*eys-Smooth Keys* or Hotkey: Alt+O

•you can hold Alt+O for fast repetition of the smoothing steps

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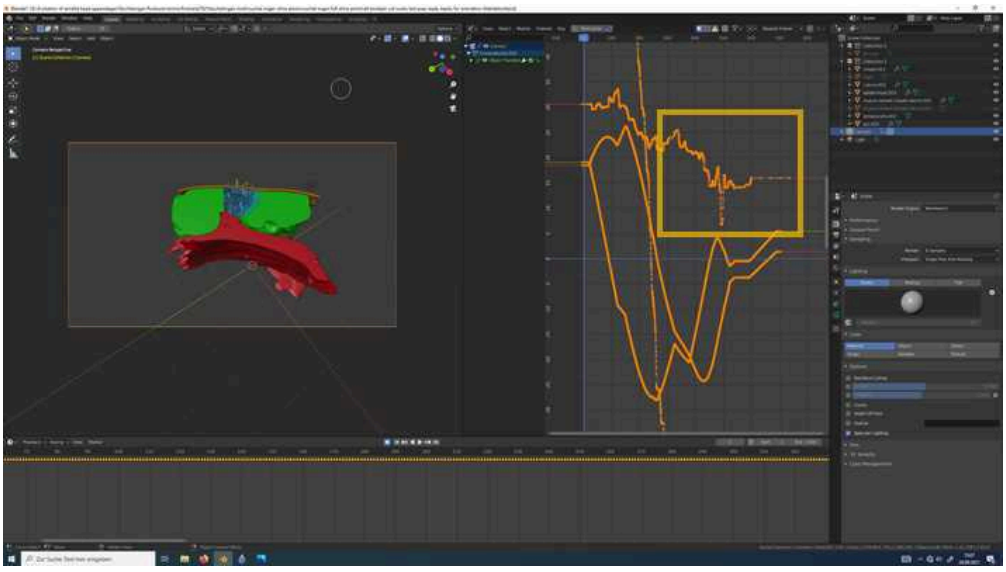
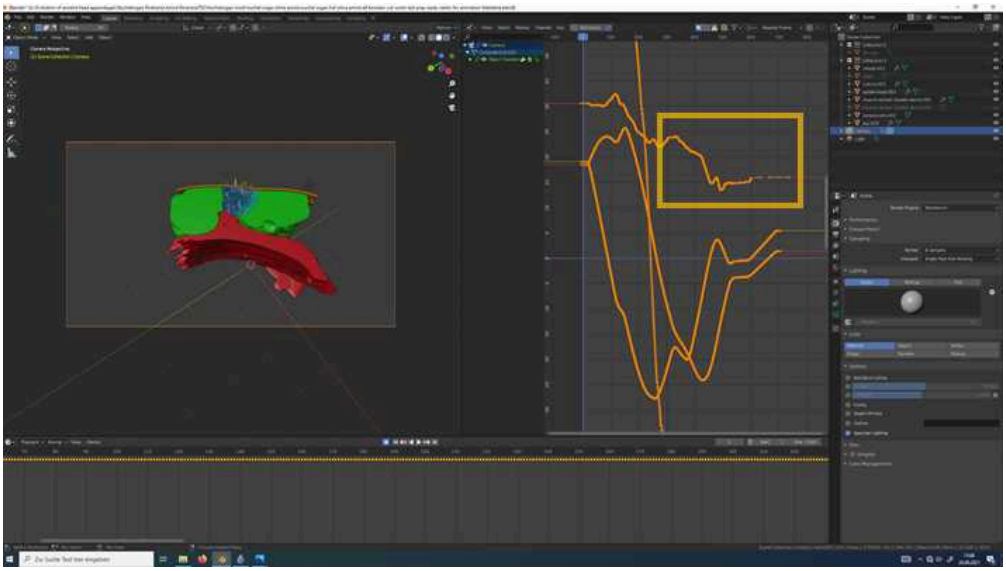


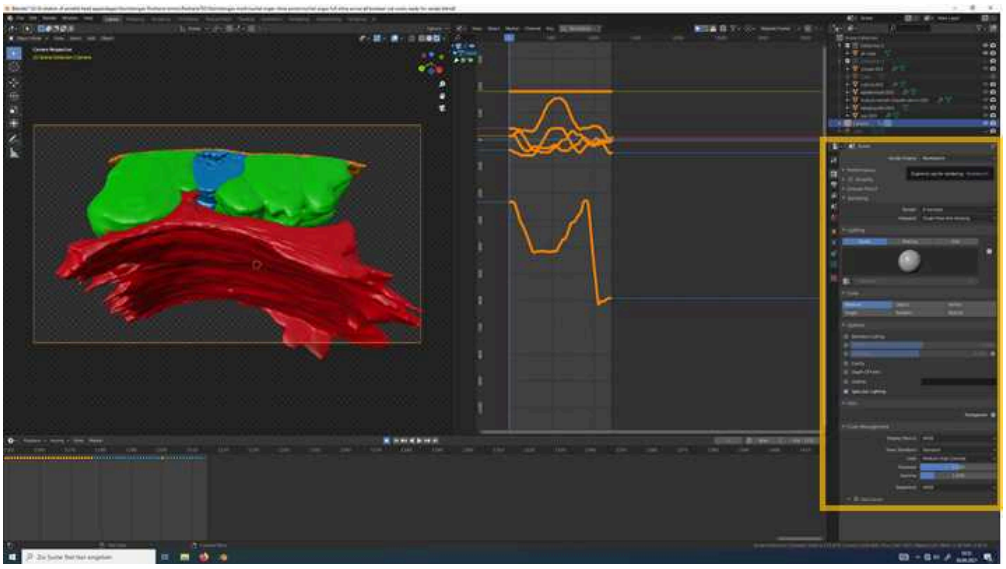
•Graphs without smoothing

45



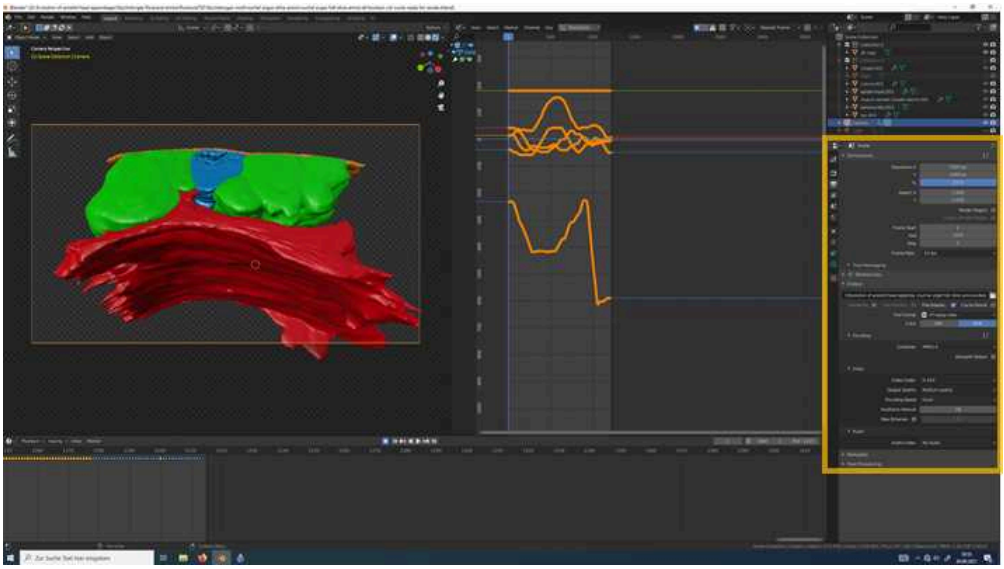
•Graphs after smoothing

46



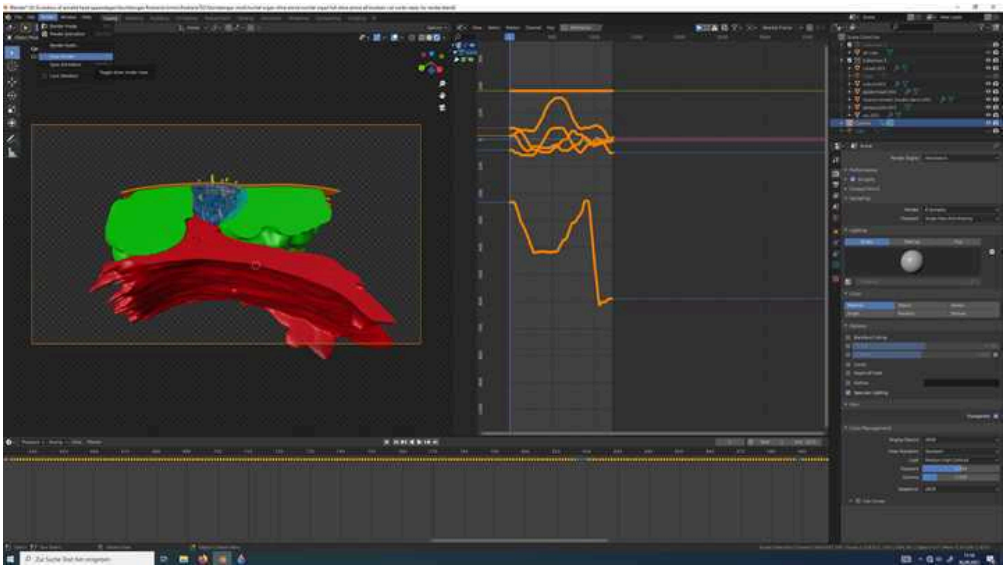
•*Render Properties* we used, also see: https://www.youtube.com/watch?v=zqK4m8a52U8

47



•*Output Properties* we used, also see: https://www.youtube.com/watch?v=Gifto41kpJw

48



-Now everything is set up for the first render:

•Go to the main tool bar on *Render-View Render* or Hotkey F11

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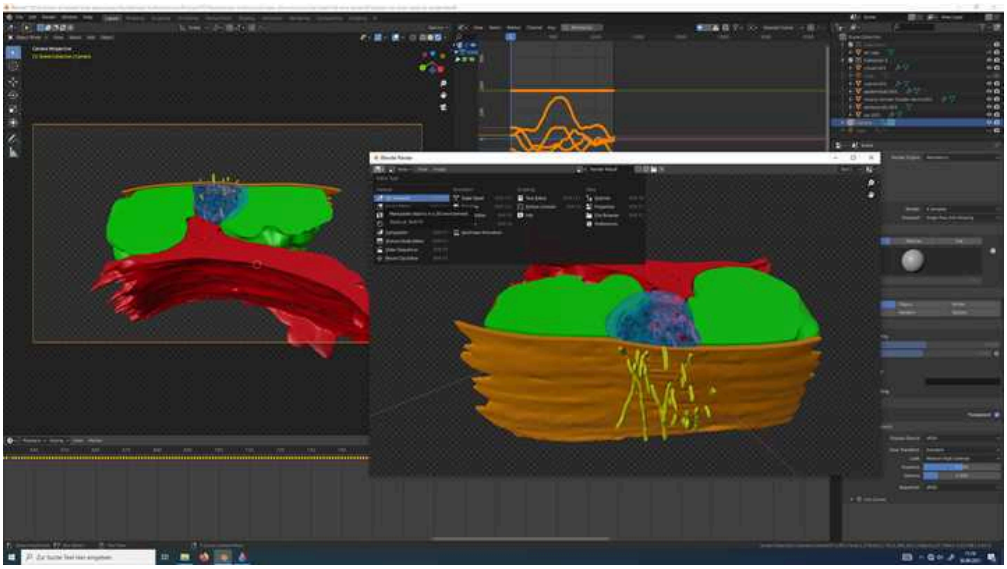

•This render window will pop up
•Change in *Editor Type* to *3D Viewport* to follow your render in real time
•You can also change to the camera View by pressing numpad 0

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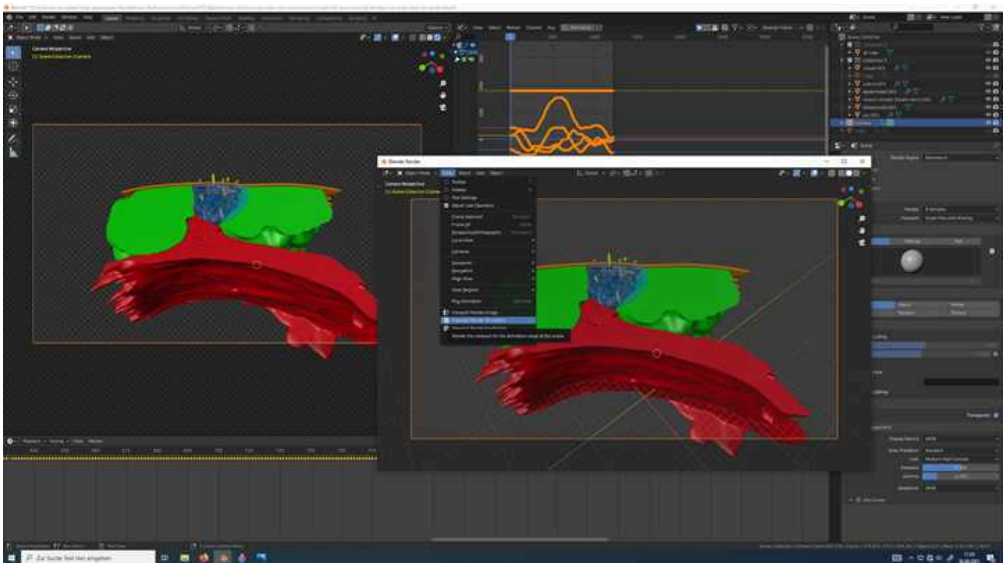

•Go to *View-Viewport Render Animation* in the render window to start a very fast render of your animation

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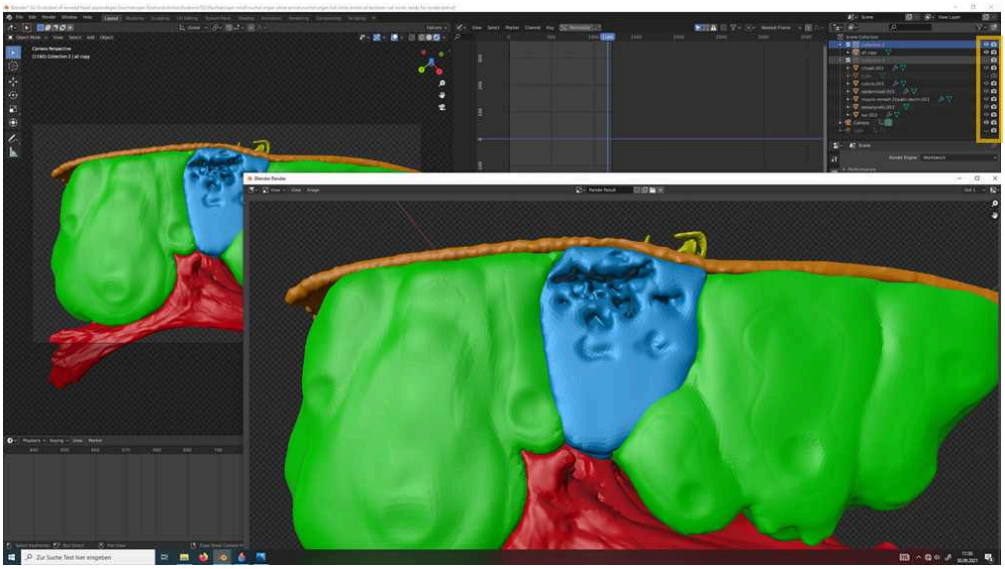

•There are different options how to change between the cut and uncut version of your structure of interest
•The first, more easy but also more error-prone option is to press *Disable in Render* (the camera symbol in the Scene Collection) for one Collection (e.g. uncut version)and change it during the render
→ As a result you see at the beginning of the render the uncut version of the nuchal organand switch to the cut version in between
•It might happen, when e.g. you are not fast enough that the switch between the version is not clean in your video
- If it is unclean you can open your video in the *Video Sequencer* and cut out the 1-3 frames and render it again (see next steps)

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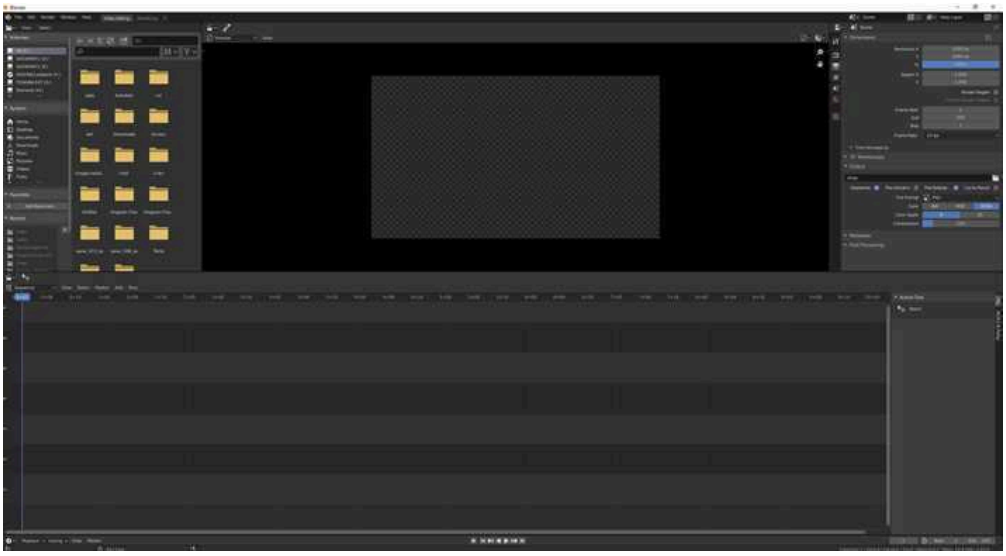

•The other way is to render two videos with each version and put them together in the *Video Sequencer*
•To open it, go to *File-New-Video Editing*

→ Also see:
https://www.youtube.com/playlist?list=PLIXsqAWo0V6IiiThMKxaezET2sdO7grjQ

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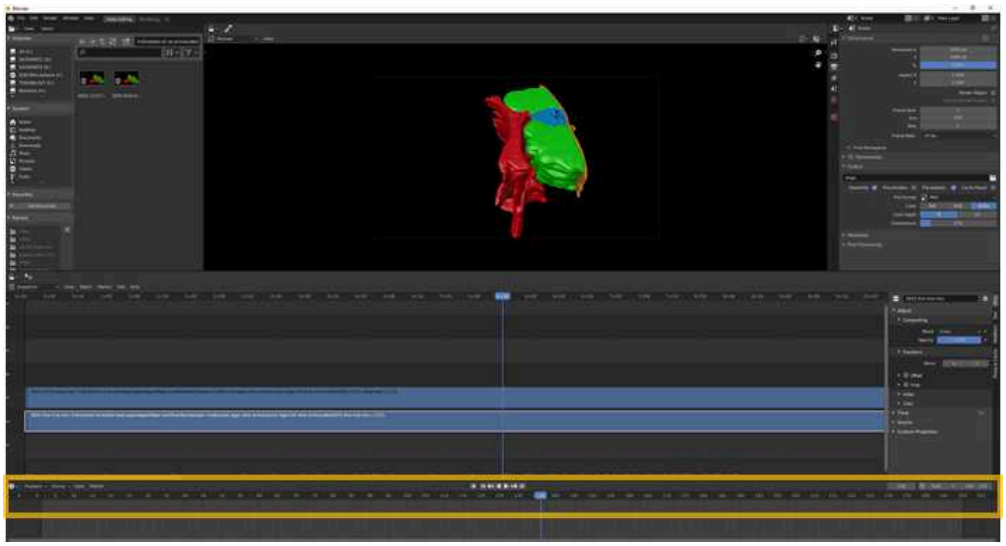

•Drag and drop your two videos in the *Sequencer*
•Pull up the *Time Line* below

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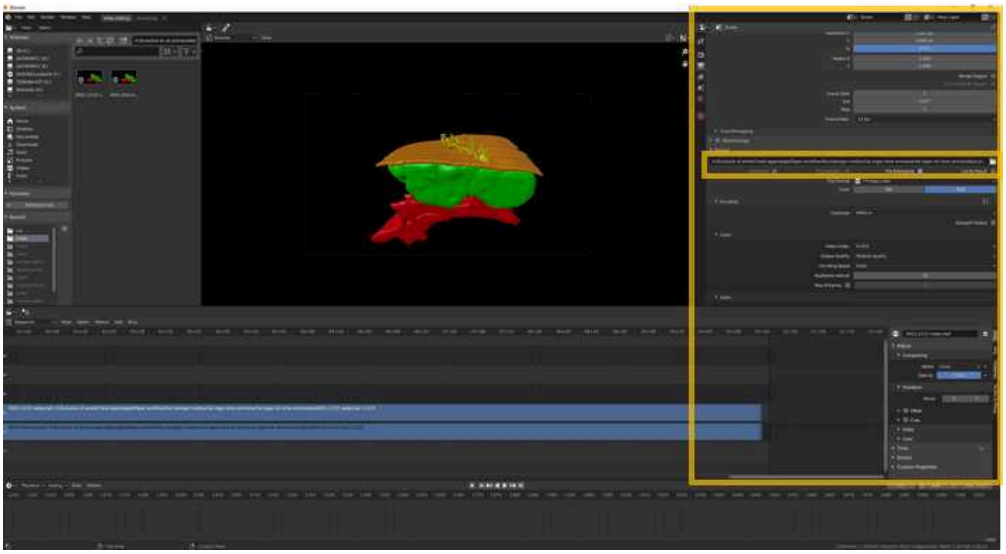

•Set the *End frame* in the Time Line higher, minimum of your video strips (see black vertical line in Sequencer)
•Adjust the *Render* and *Output Properties* e.g. like in your original renders
•Give your new video a name!!

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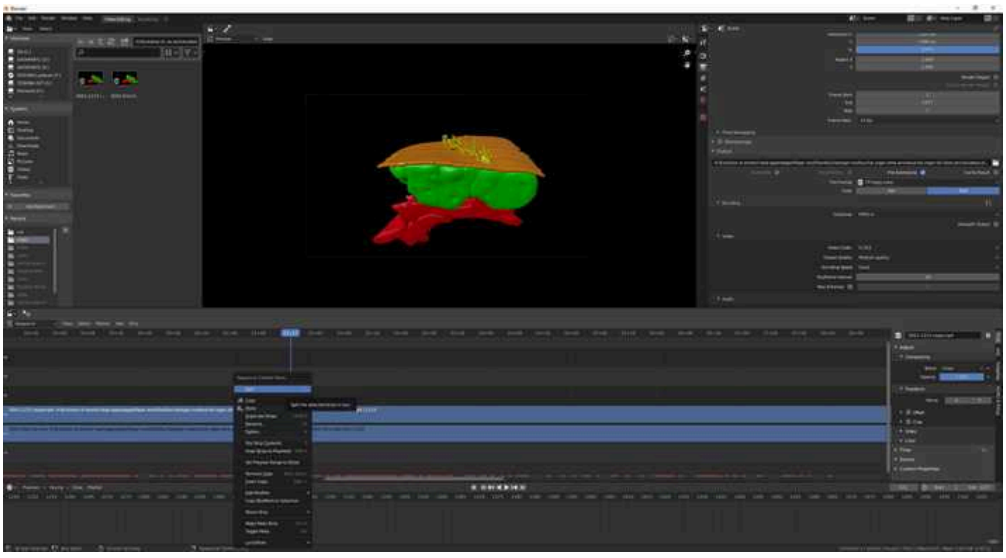

•Select one of your strips
•Pull sequencer to frame you want to cut
•R mb –*Split* or Hotkey K

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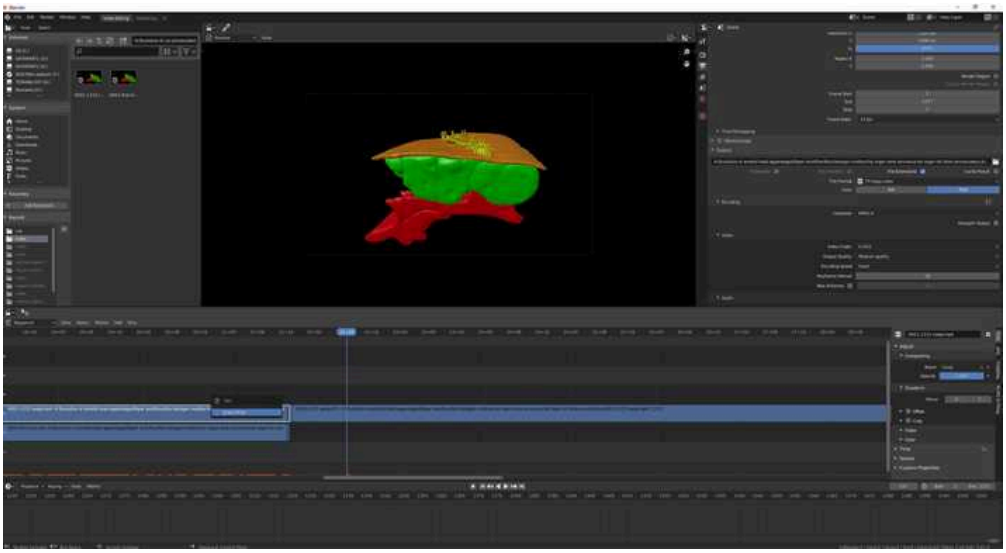
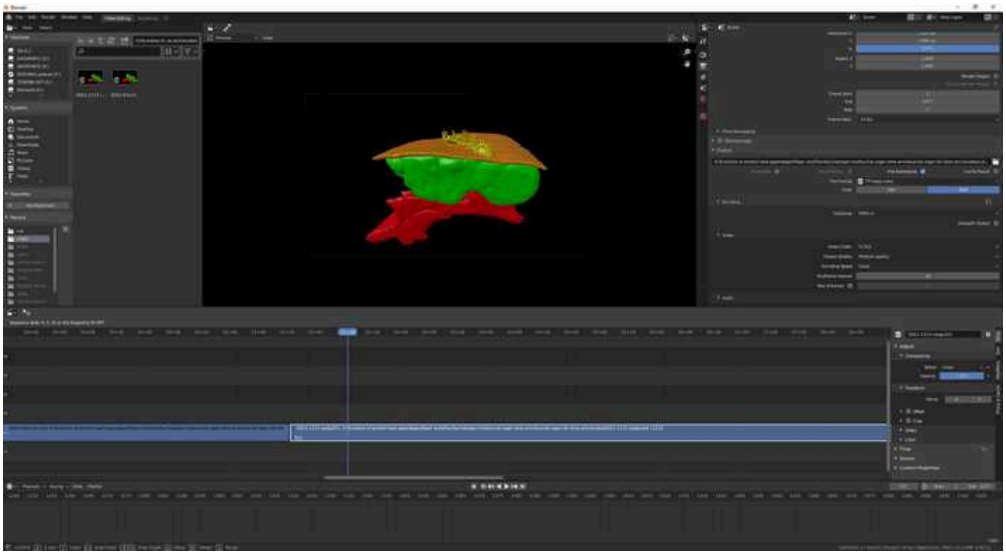


•Do that for both strips and *Erase Strips* by r mb or select and press delete button

57



•Pull both strips in the same channel

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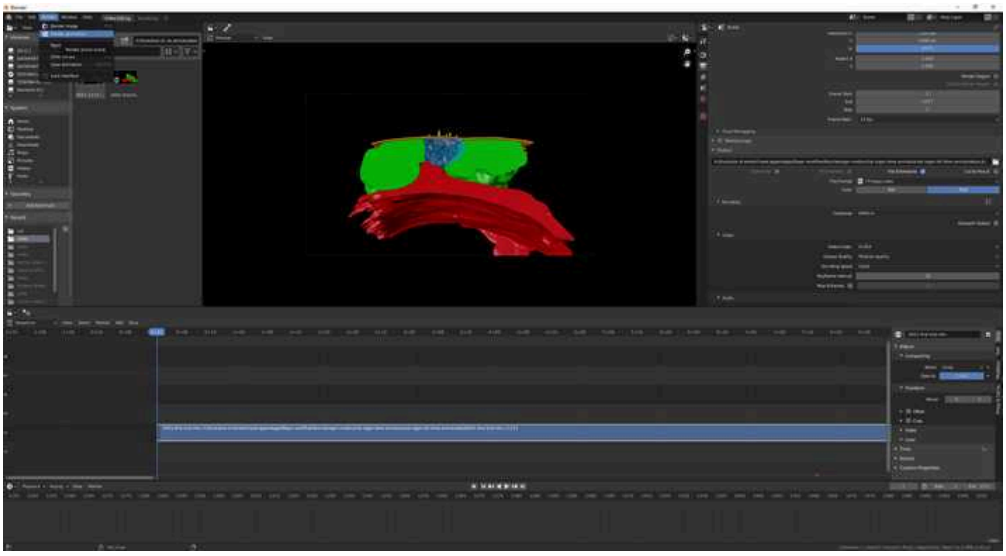

•Start Render by click on *Render-Render Animation* in main tool bar
•DONE. Enjoy!!!