Introduction to musculoskeletal modelling

Blender part 1
Building joints and contact points

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Building joints and contact points

Blender (https://www.blender.org/) is a free and open-source 3D computer graphic software application used for creating films, visual effects, etc. We will use this software during the practical, which has been already installed on the university computers.

A live introduction to Blender will be done at the beginning of the practical.

The objective of this first part is to **build two points**:

point.tmj will be located at the temporomandibular joint (TMJ)

point.bite_inc will be located at the right central incisor on the mandible

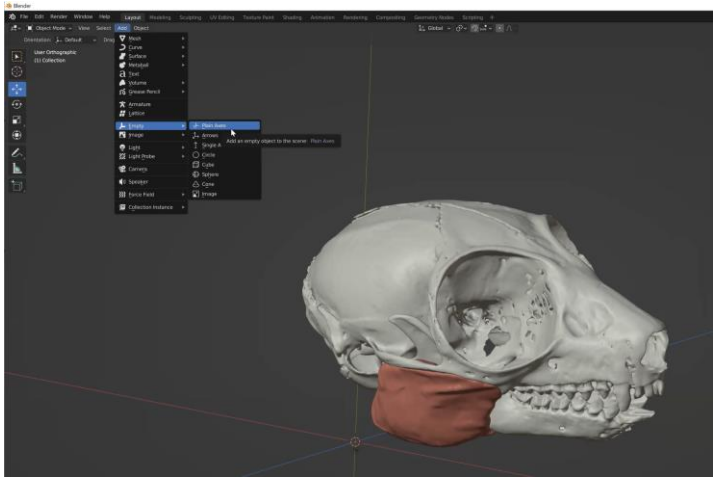
These points will allow you to **extract the 3D coordinates** of the TMJ and bite point that will be **copied into a .csv file**.

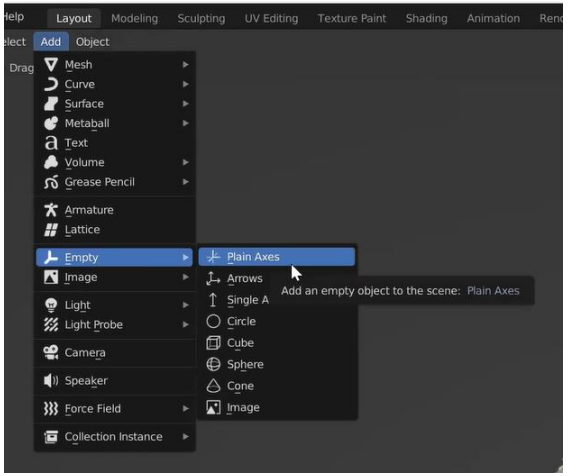
This document provides you with a step-by-step tutorial to achieve this goal.

Save (Ctrl+S) your work regularly!

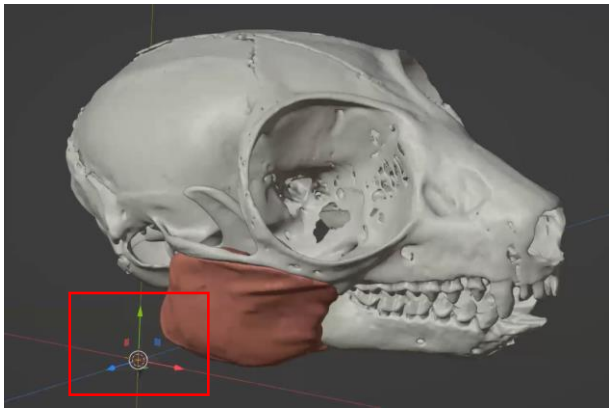
Building joints and contact points

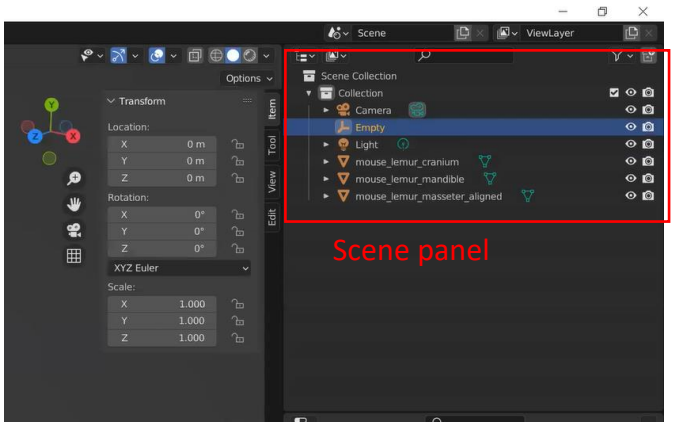
1. Create a point that will be located at the jaw joint (0:13). Go to Add > Empty > Plain Axes.

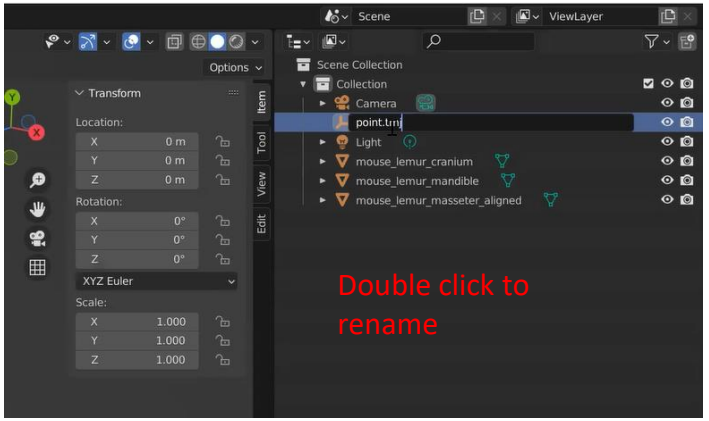




2. A plain axis called “Empty” is created at the world’s origin [0, 0, 0] and shows up in the Scene panel. Rename (0:21) the plain axis in the Scene panel as: **point.tmj**







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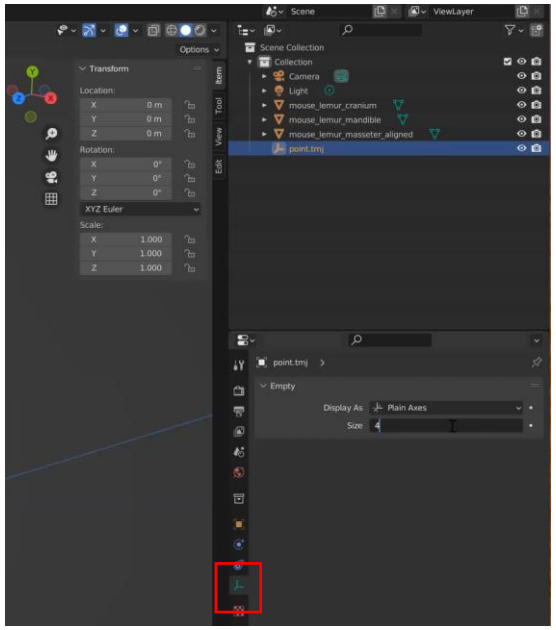
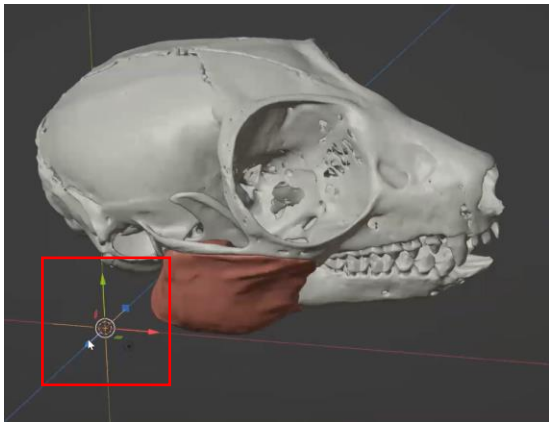
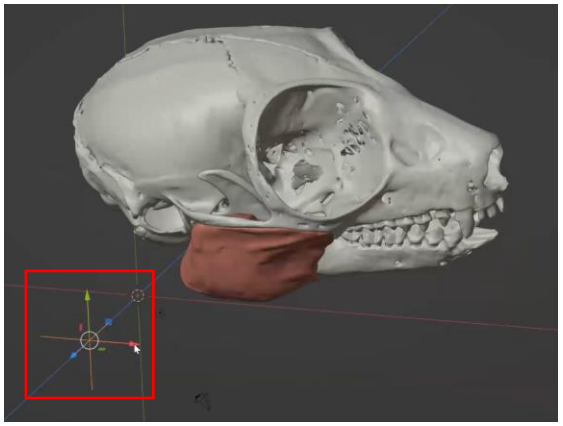
3. You can increase the size of the point (0:31). Select “point.tmj” and go to the Empty tab. Change the size to 4.

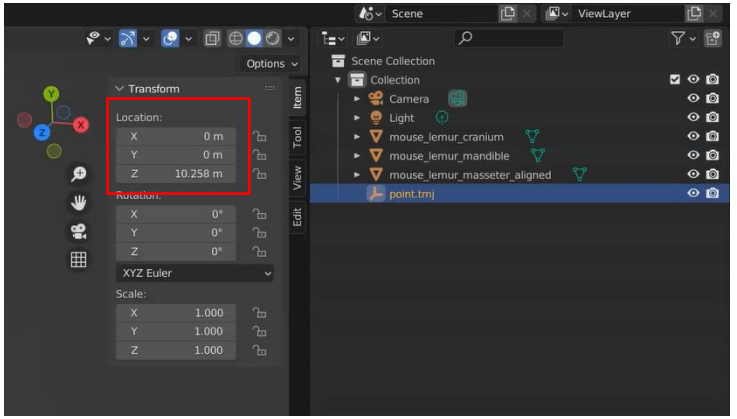


4. How to move the point (0:41). Select the point and the red (x), green (y) and blue (z) axes will appear. **Translate the point along a given axis by clicking on the axis and holding the right mouse click while you move.** You can move the object in 3D (all axes) by clicking on the centre of the object and holding the right mouse click while you move; this is however less precise.





As you move the axis along the Z axis, you can see that the point coordinate changes in the **Item panel i**n the **top right corner of the window**.



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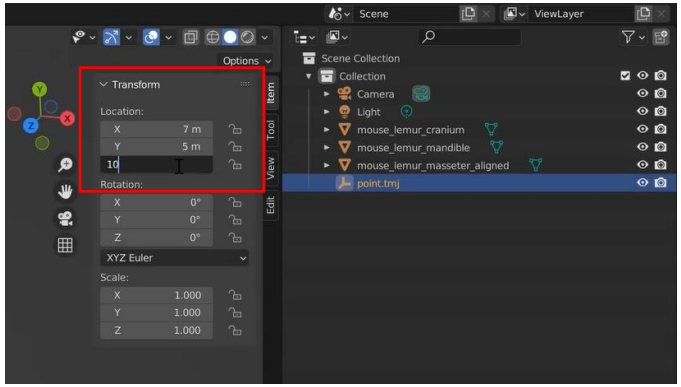
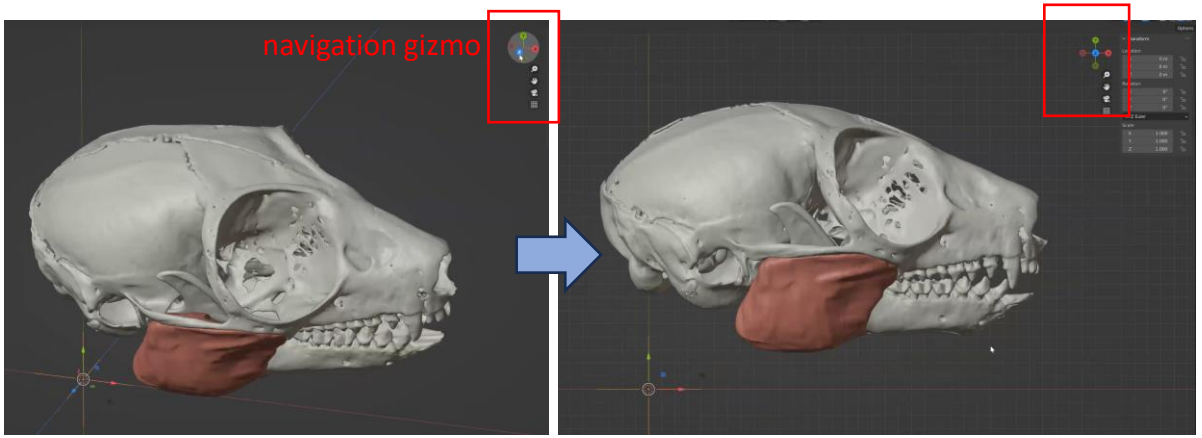
5. Coordinates can also be entered in the transform tab to move the object (1:00).



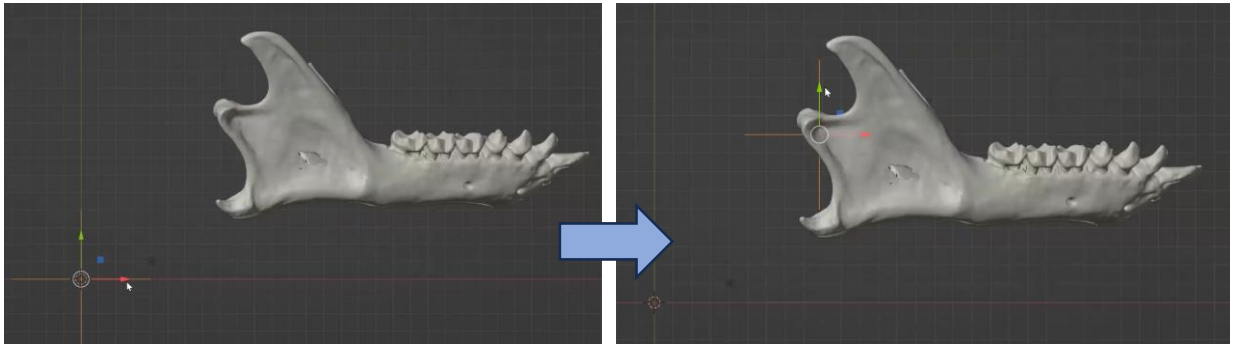
6. The **Navigation gizmo** on the top right corner of the window shows the current orientation of the view. You can use it to change your viewpoint (1:23) and align it with the anatomical axes (X, antero-posterior; Y, dorso-ventral; Z, latero-medial).
Click on Z to align your view perpendicular to the Z axis (lateral view).



7. Select point.tmj and **move it along the X and Y axes to the level of the TMJ** (1:36).

You are advised to hide the cranium and muscle by clicking on the eye icon next to each object in the **Scene panel**.

You can zoom in to perform fine adjustments (1:45).



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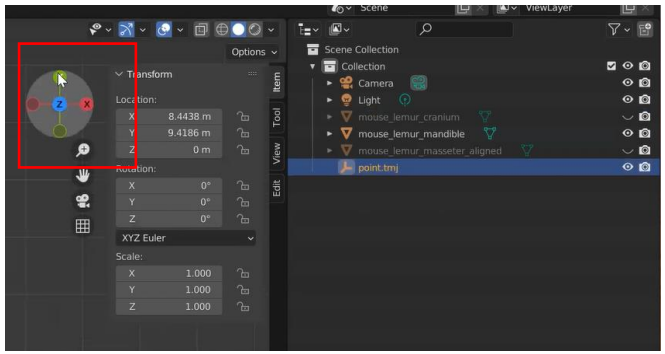
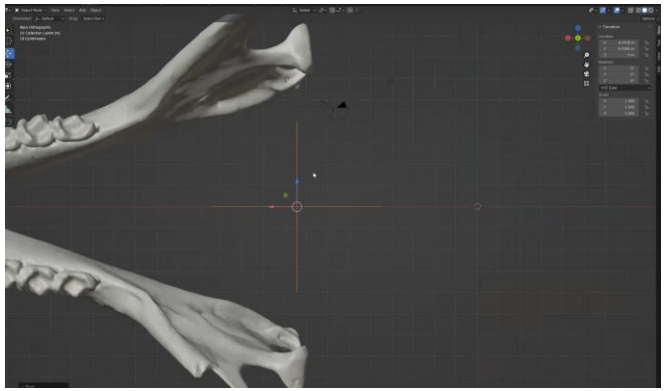
8. Change viewpoint to move the point along the Z axis (1:58). On the **Navigation gizmo**, click on Y to align your viewpoint with the Y axis (dorsal view).

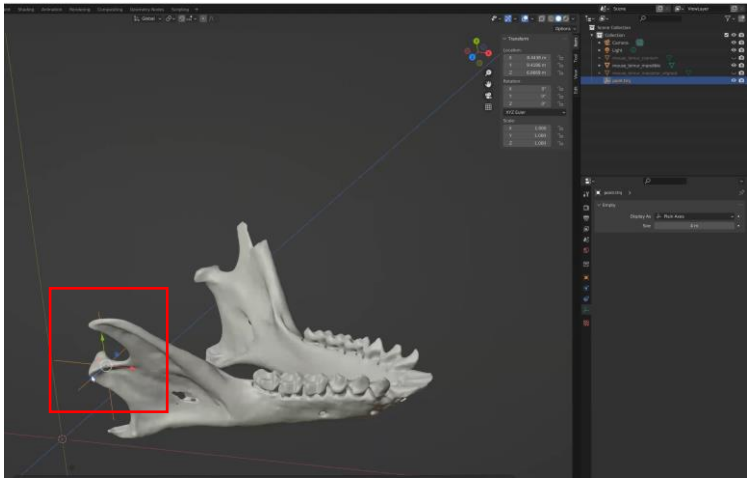
You can see that the point is centred between the right and left TMJ.





9. Click on the Z axis of the point to drag it to the right TMJ and centre the point in the middle of the condyle.

10. The point.tmj in position



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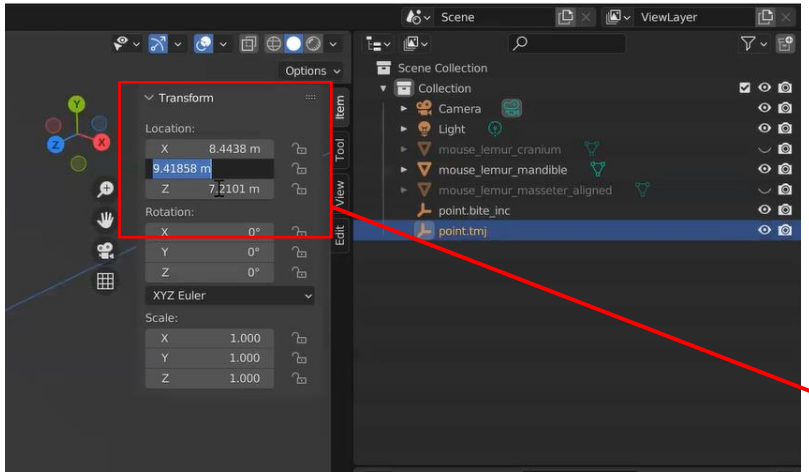
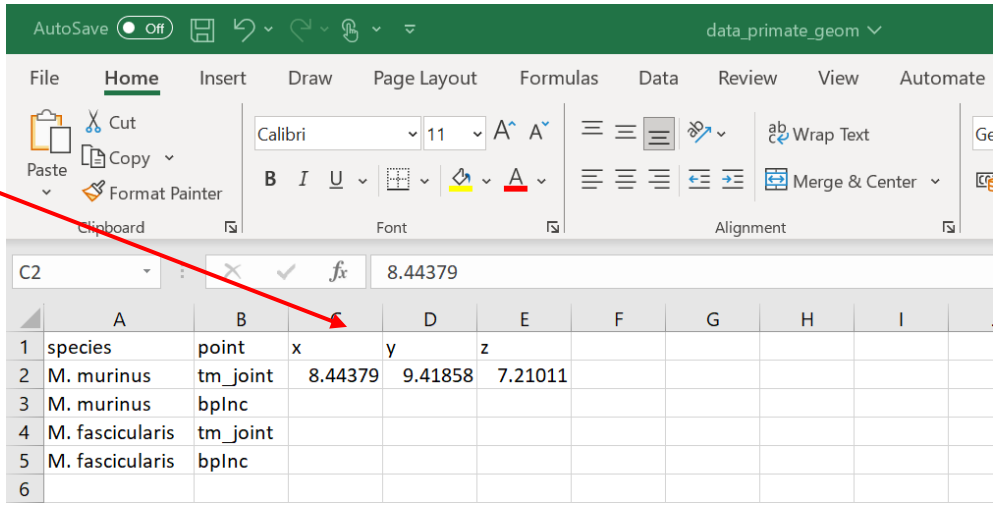
11. Now build the **point.bite_inc** following the same procedure (2:40). Place this point at the **tip of the right central incisor**.

12. Once all the points have been created, export their coordinates (3:30). Select one of the points in the Scene panel on the right, and copy-paste each X, Y, Z coordinate from the Transform panel (double click on the coordinate, select, and Ctrl+C).



13. Open **data_primate_geom.csv** and paste the X, Y, Z coordinates of each point and save. Carefully check if the coordinates you have copied are correct. <u>Do not make any other edit in this file!</u>



	A	B	C	D	E
1	species	point	x	y	z
2	M. murinus	tm_joint	8.44379	9.41858	7.21011
3	M. murinus	bpInc			
4	M. fascicularis	tm_joint			
5	M. fascicularis	bpInc			
6					