

# Data Driven Computer Animation

HKU COMP 3360

Tutorial 1 - Data structure and pipeline in Character Animation

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SECTION 2A, 2021

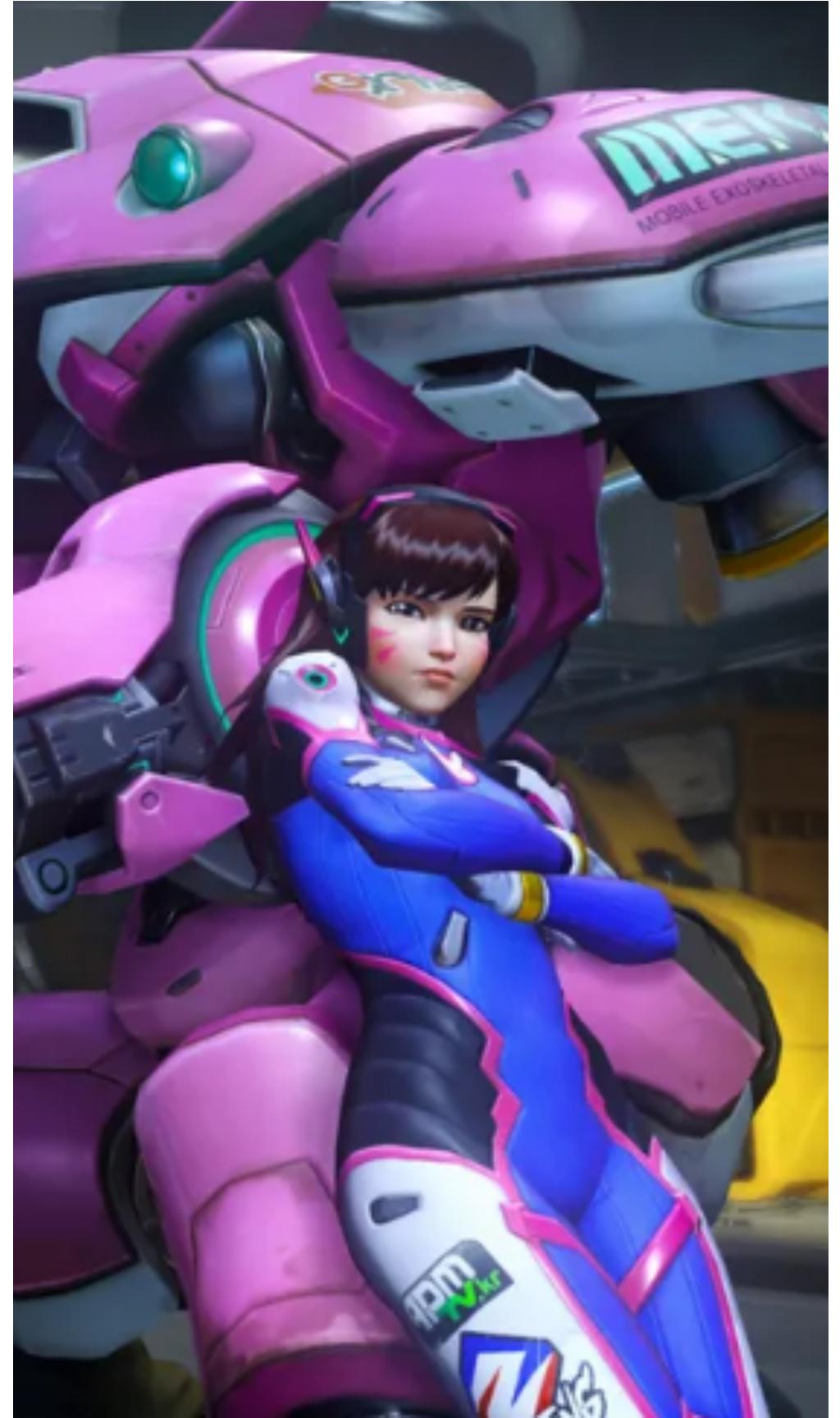


# Tutorial 1 - Data structure and pipeline in Character Animation

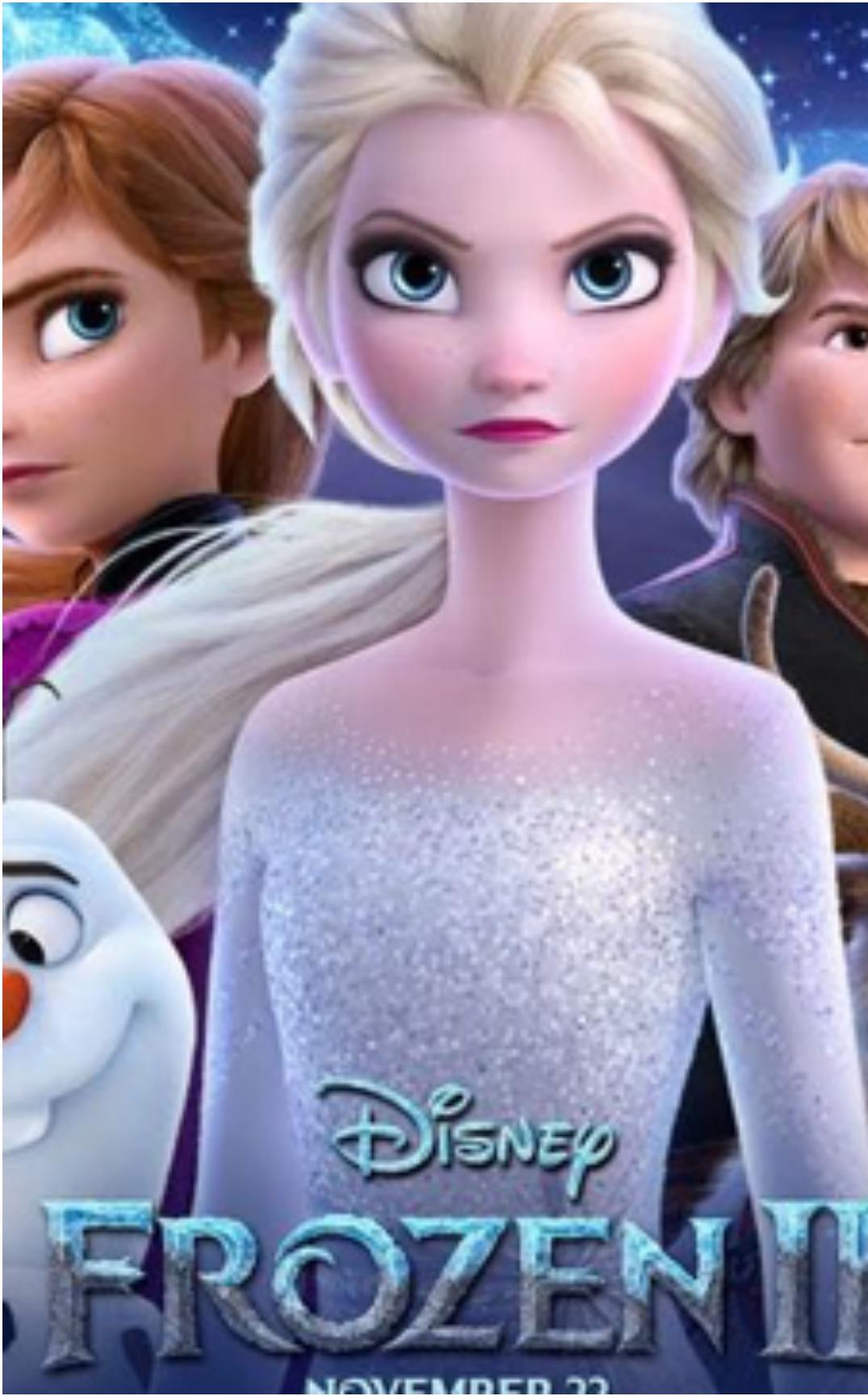
- Data structure and representation in Character Animation
- A simple way to create Character Animation in Blender
  - Keyframe Animation
  - Motion Capture

Resources: [https://github.com/Shimingyi/COMP3360\\_Data\\_Driven\\_Animation](https://github.com/Shimingyi/COMP3360_Data_Driven_Animation)

# You might be a fun of...



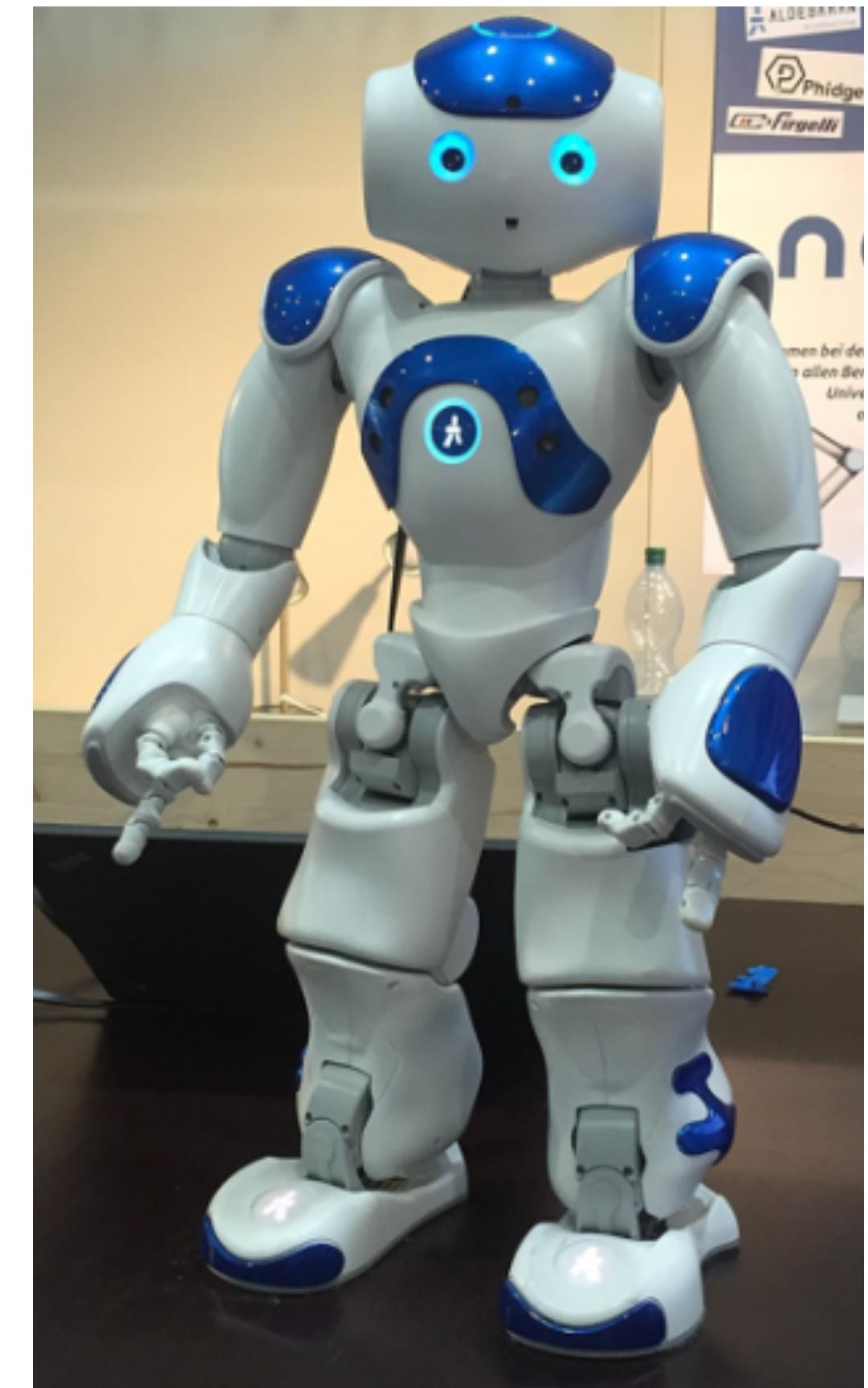
Video Games



Movies



Virtual Streamer



Robot

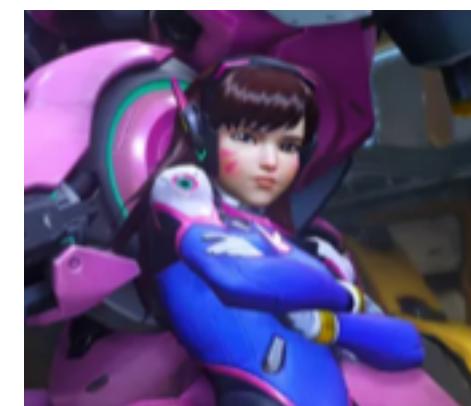
# Basic representation in digital computing

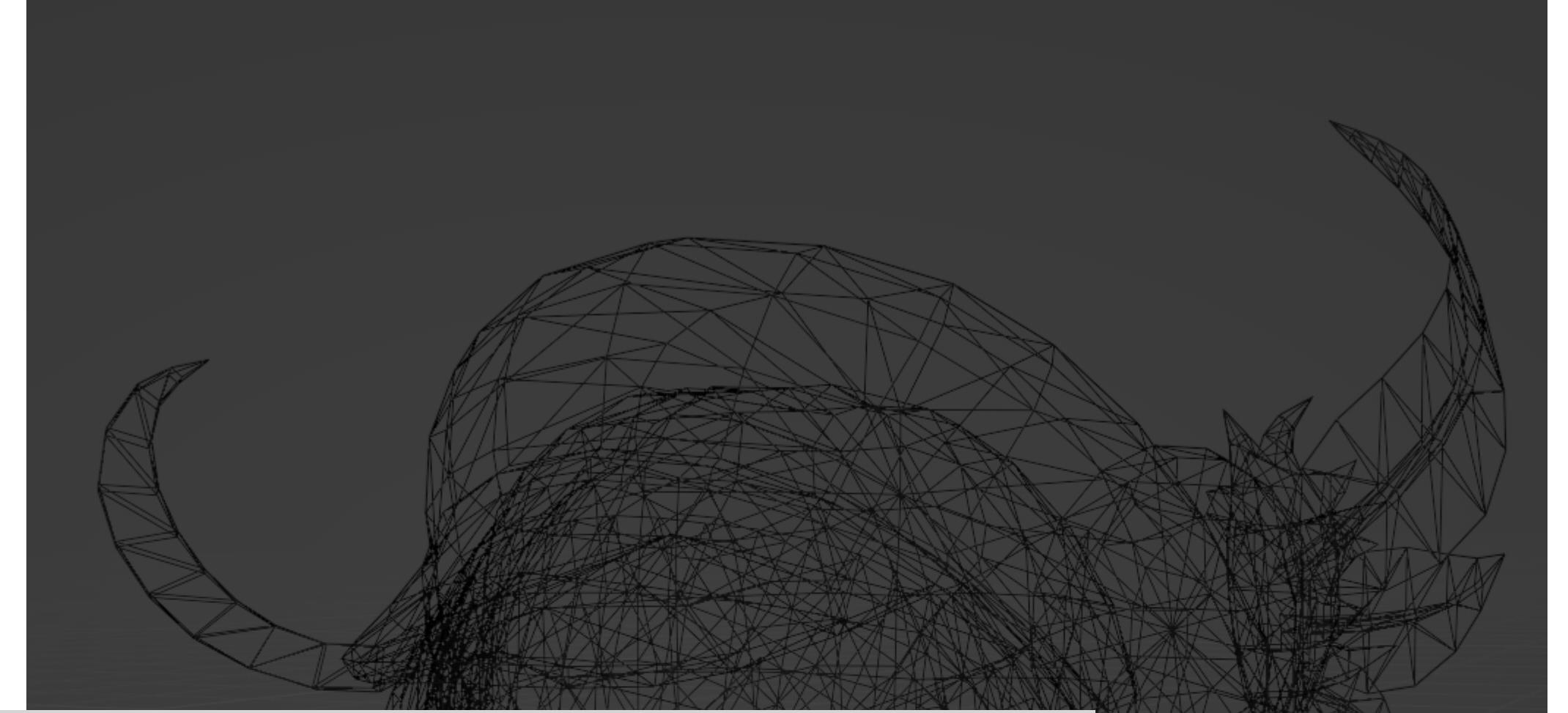
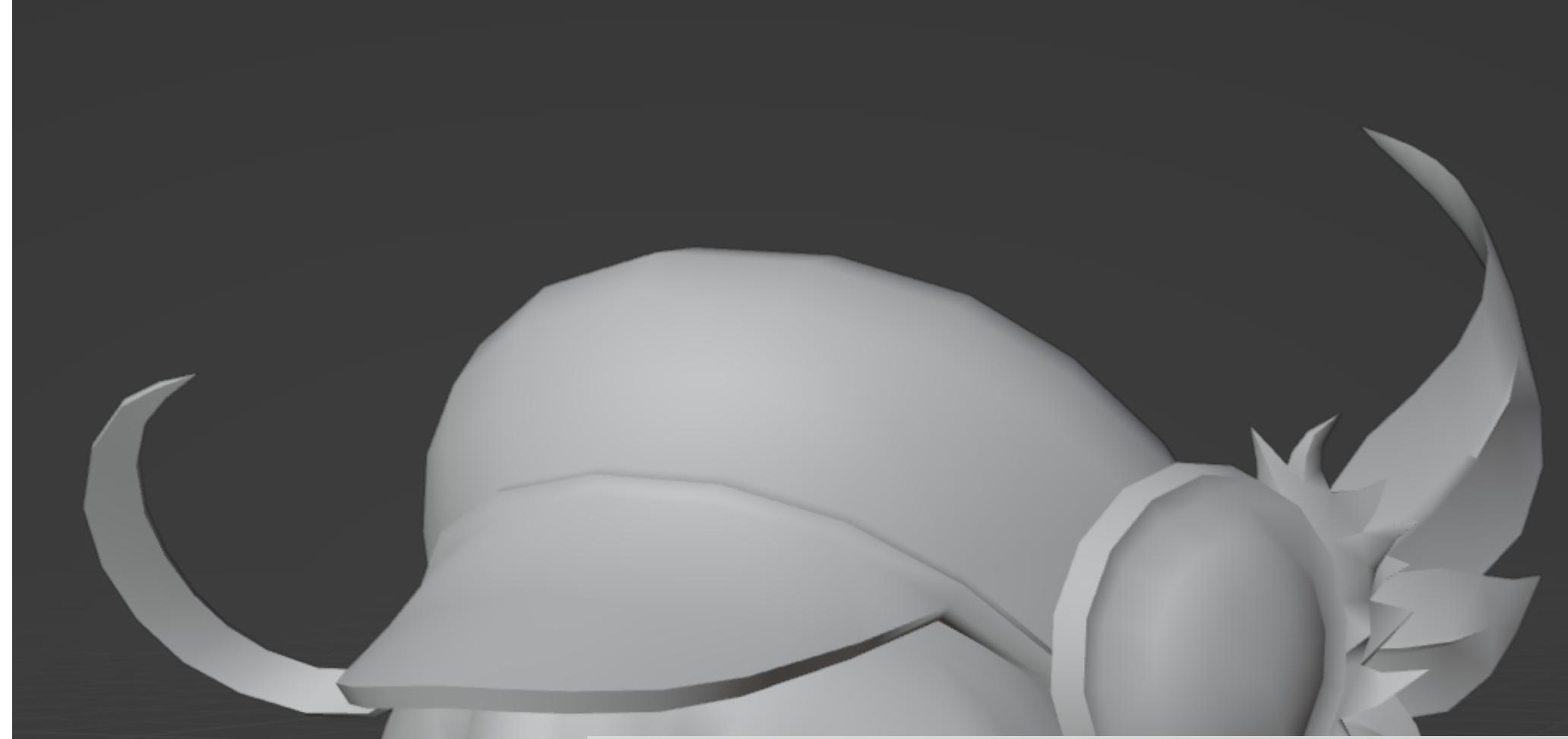
## Everything is based on a specific data structure

- String -> characters -> codes (ASCII)
- Image -> pixels -> 2d array / 3d array
- Voice -> sequence of electronic positions
- Human?

Have you thought about:

What are them?

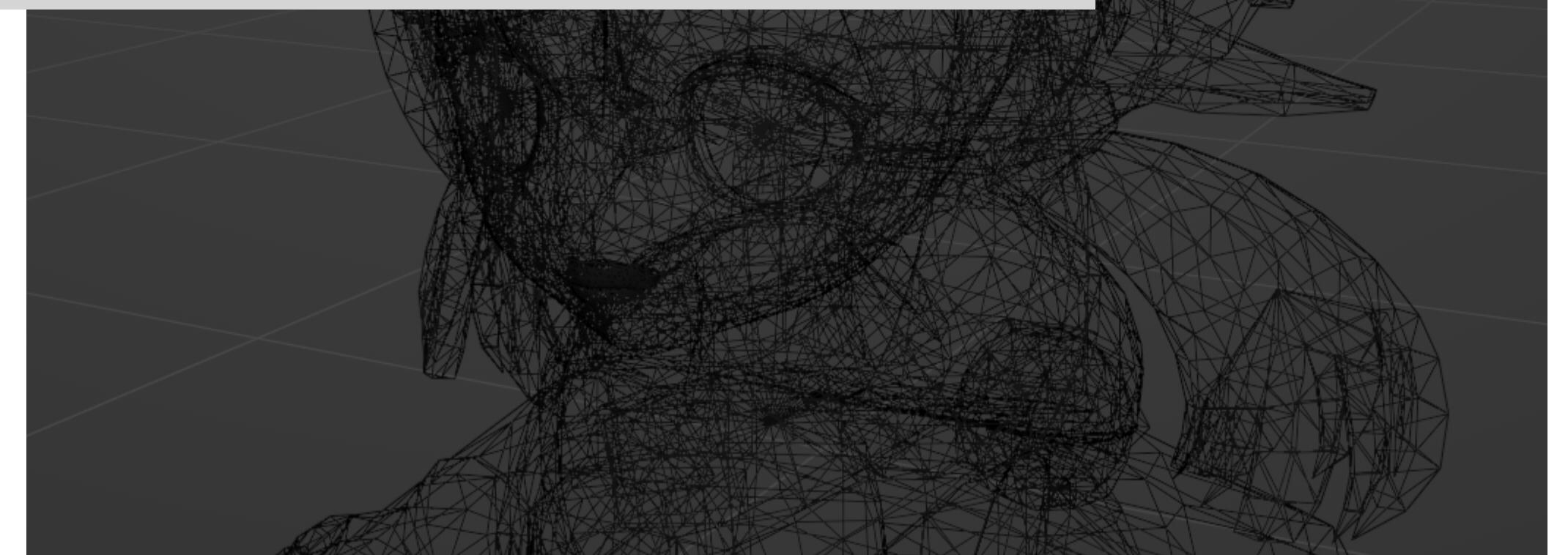




**How can we make them move?**

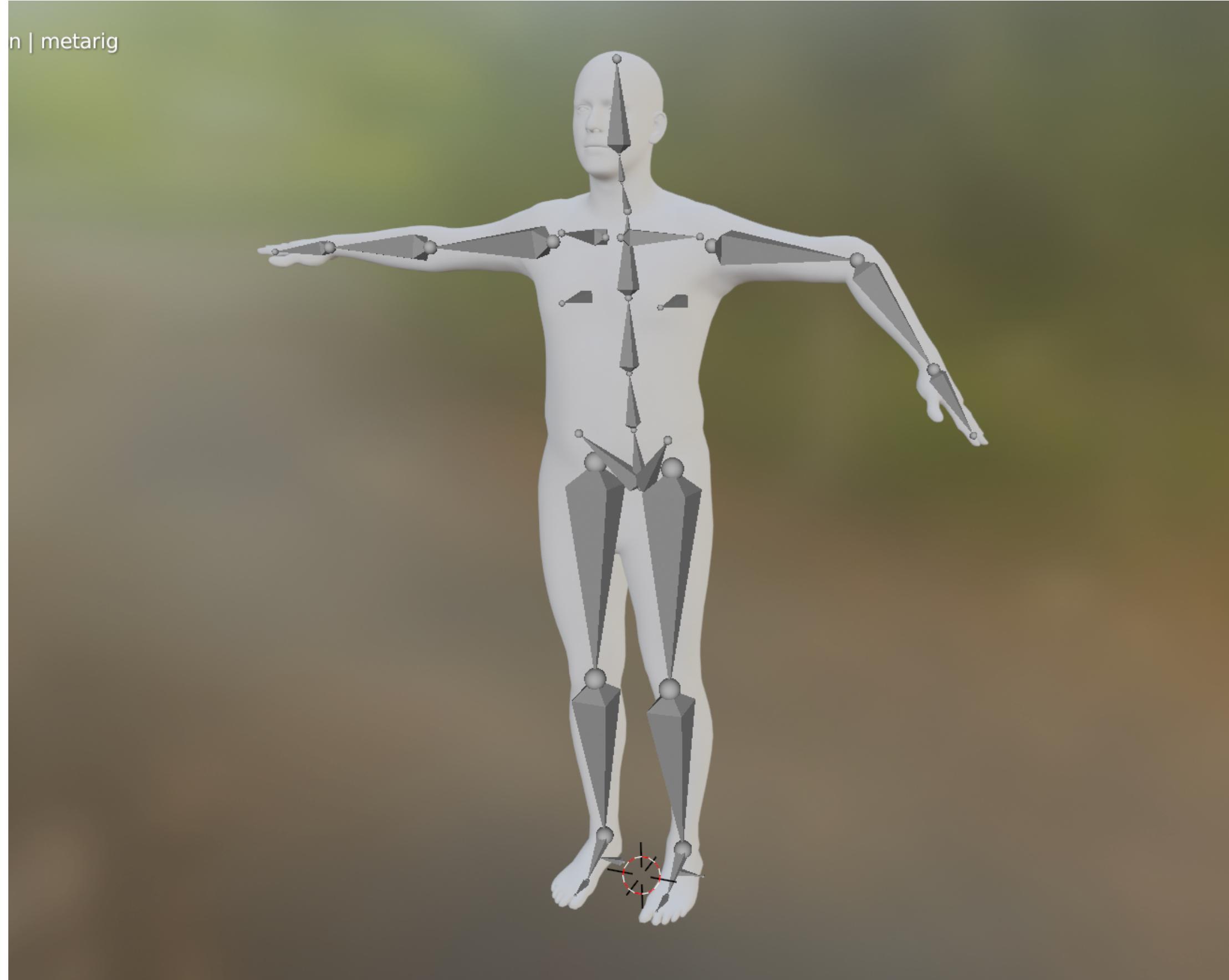


Character Mesh



Mesh (Vertices, edges and faces)

# Control the key joints (Skeleton)



Animation Example

Skeleton  
(Bones)

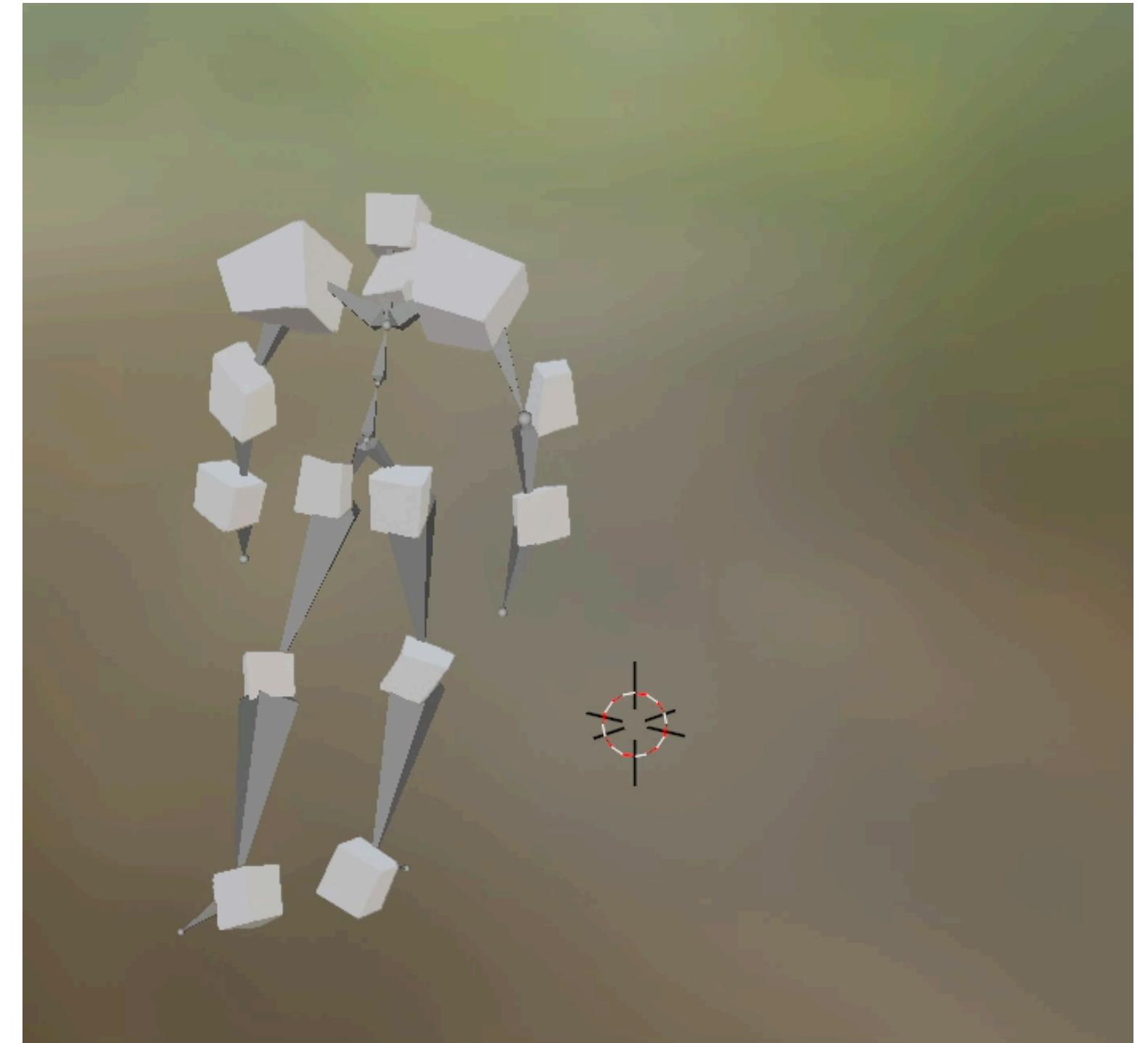
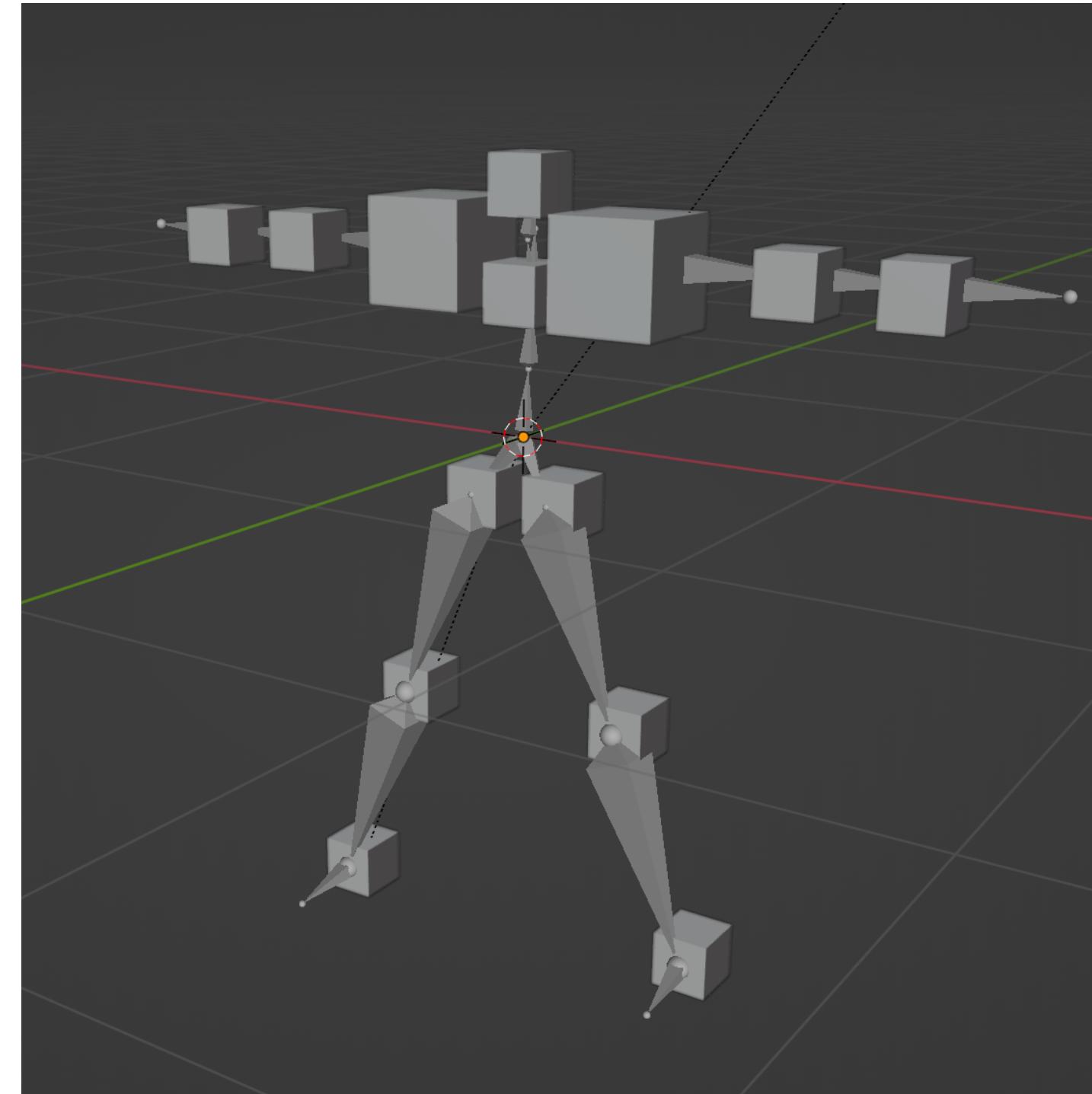


Mesh



Example: `skeleton_in_mesh.blend`

# Toy example - Blocks Body

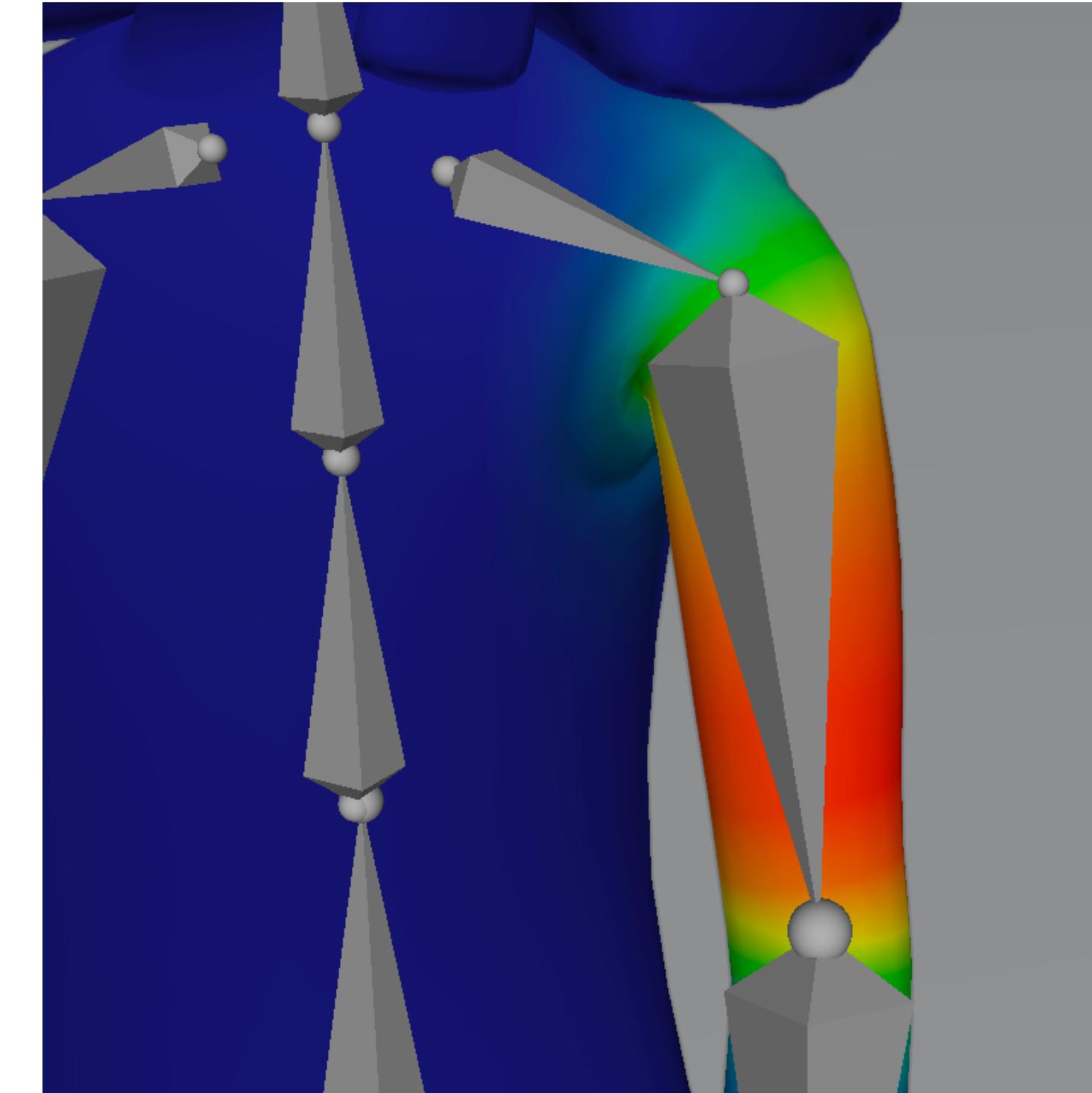
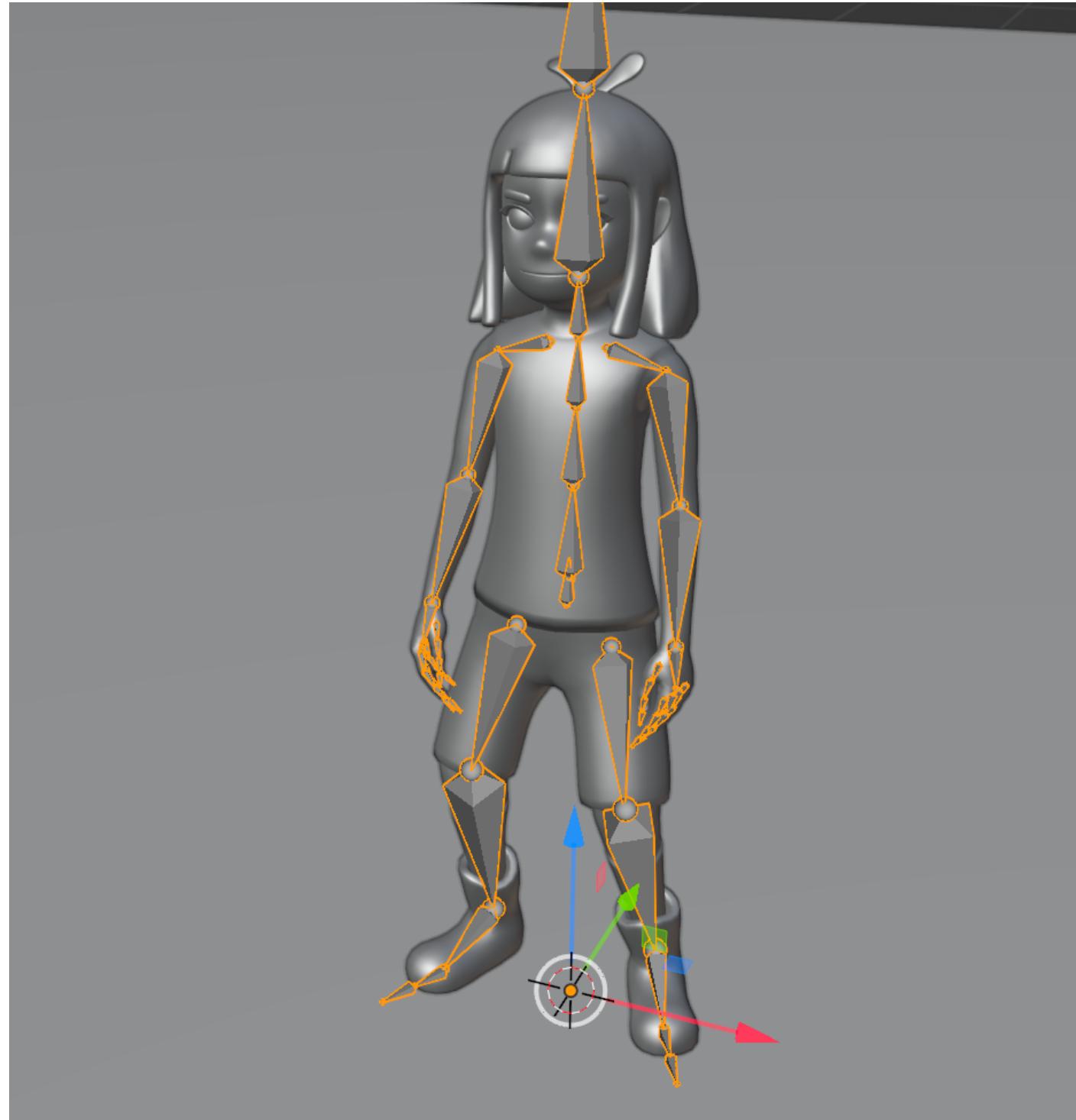


The blocks will move refer to the corresponded skeleton joint

Multi select the skeleton and mesh, press 'alt+P' to apply weights

Example: rig\_body\_blocks.blend

# Real example - Human Mesh (skinning)



Weighted binding ↑  
Mathematic details -> Refer to lecture slides (skinning)

Example: rig\_body\_mesh.blend



# **Basic Knowledge:**

1. Polygon mesh is used to present digital human
2. Skeleton will in the mesh to rig the mesh
3. A weight binding method is used to manipulate whole mesh with few key joints

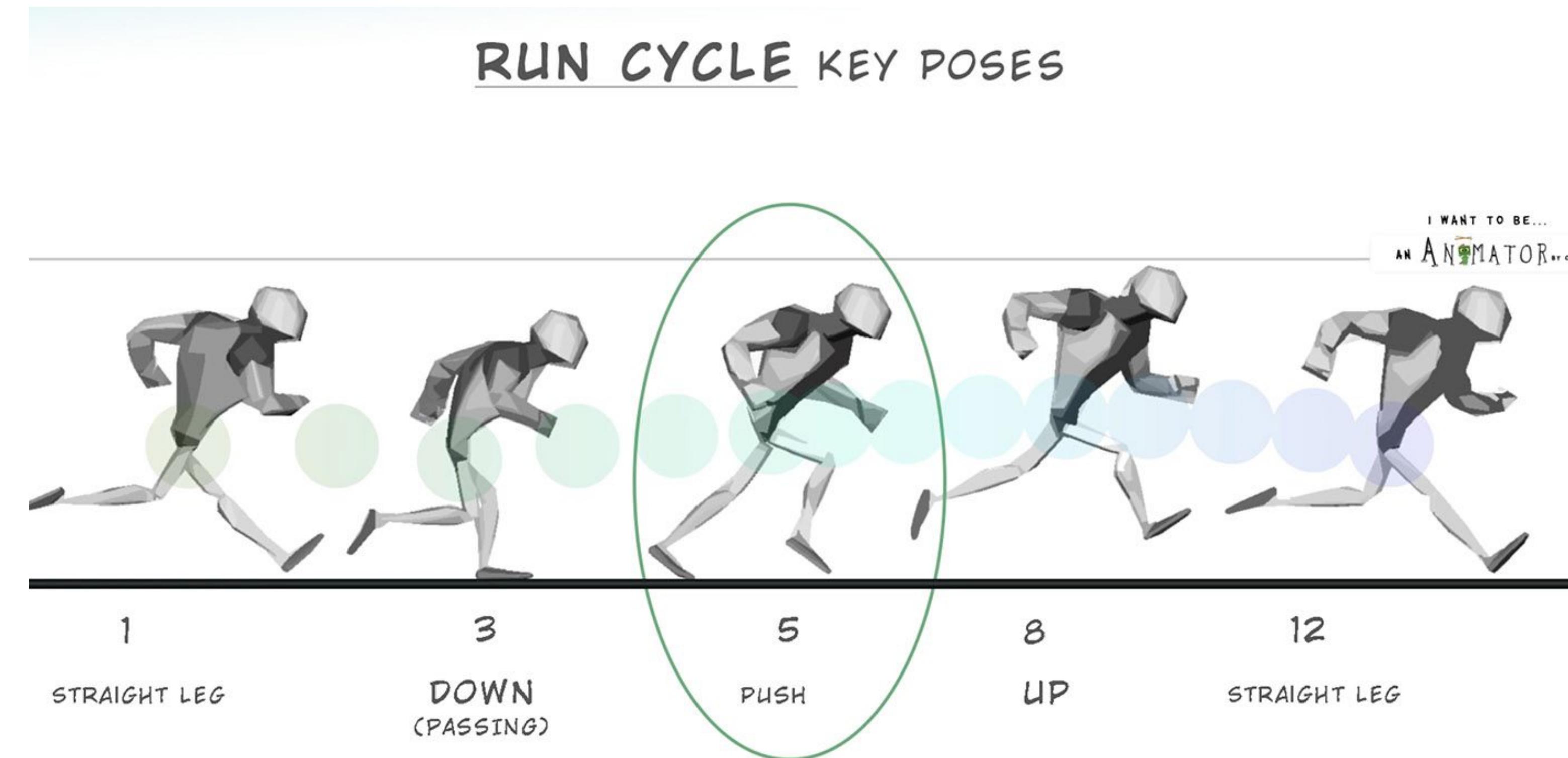
**Import Mesh -> Import Skeleton -> Bind Mesh and Skeleton**

**Then:**

# **How to make a Character Animation**

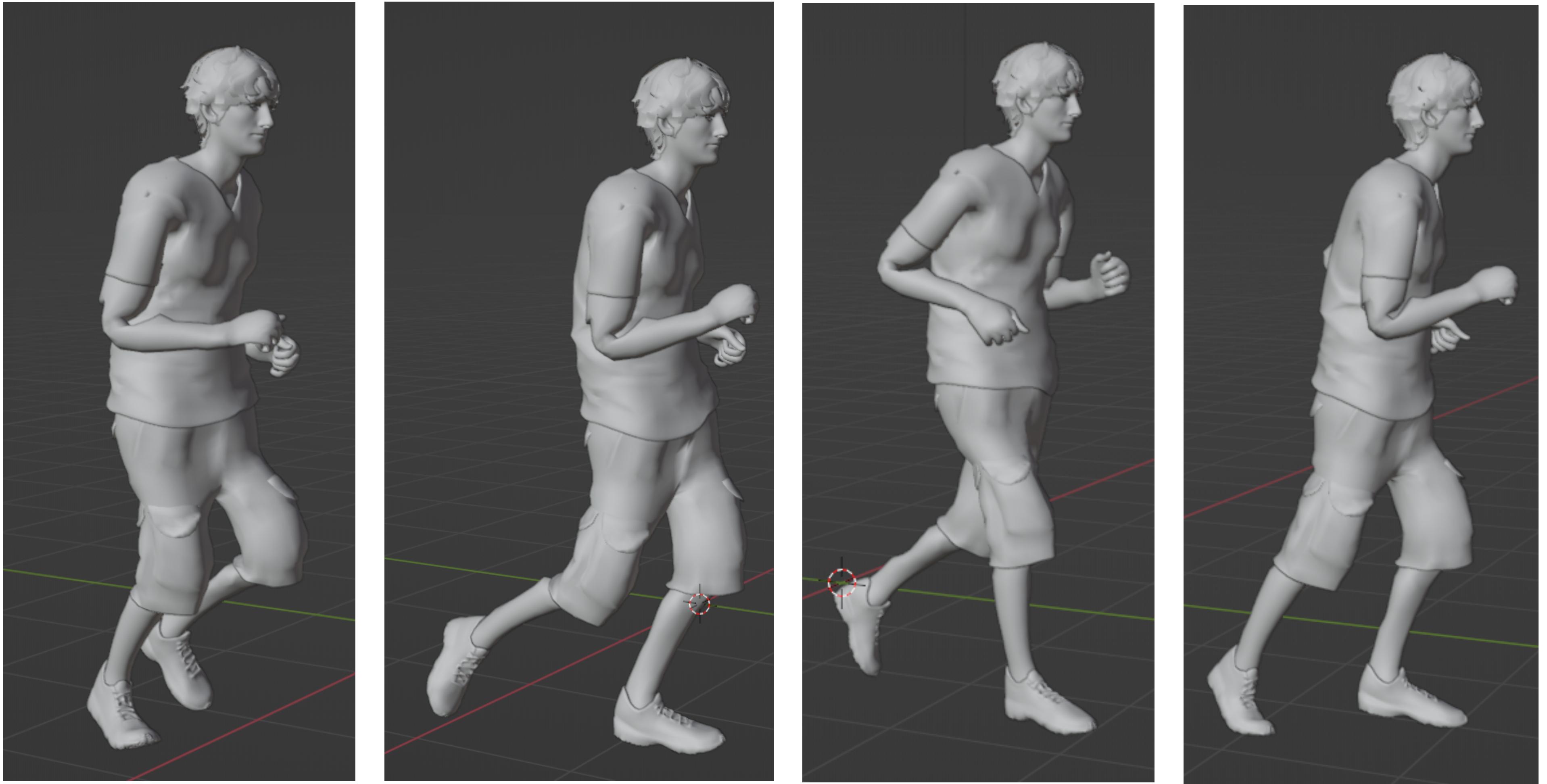
1. How to make the joint move?
2. How to make the animation to be realistic?

# Method 1 - Keyframe Animation



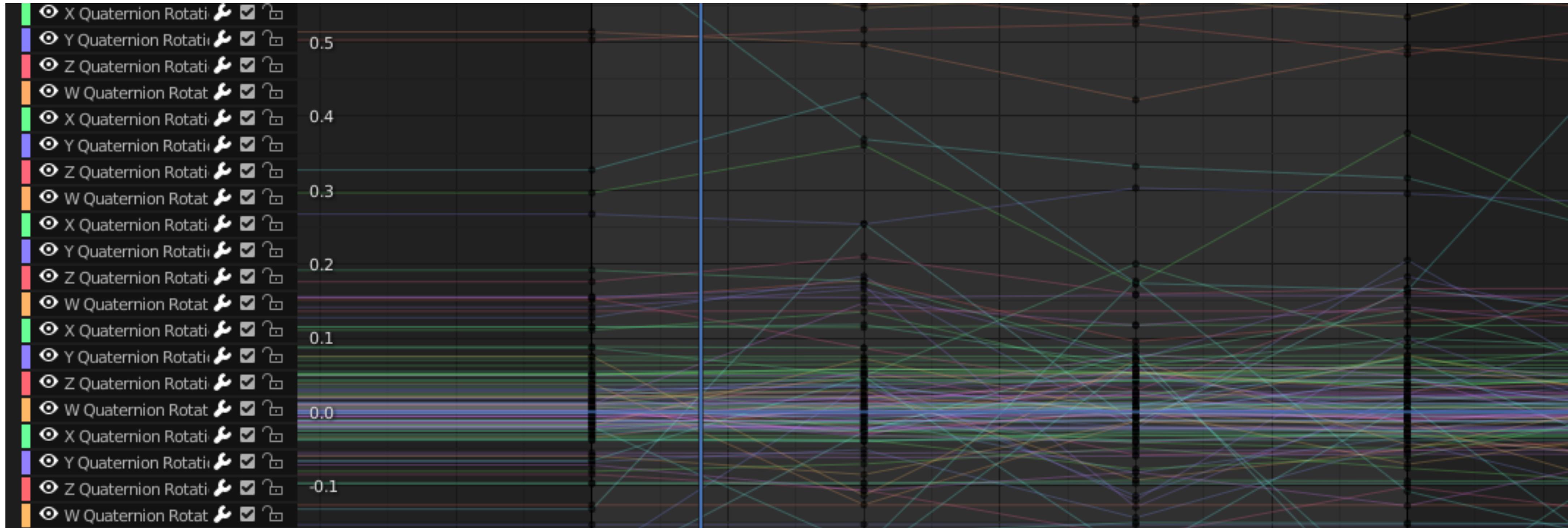
Example File: keyframe\_animation.blend

# Method 1 - Keyframe Animation



Example File: [keyframe\\_animation.blend](#)

# Method 1 - Keyframe Animation



The interpolation with Quaternion

Display it with graph editor in Blender

Example File: [keyframe\\_animation.blend](#)

# Method 1 - Keyframe Animation

1. A basic handcraft technology in animation industry
2. Requires lots of training and experiences (artist job)
3. Cannot be replaced now

Enjoy: <https://vimeo.com/390690374>

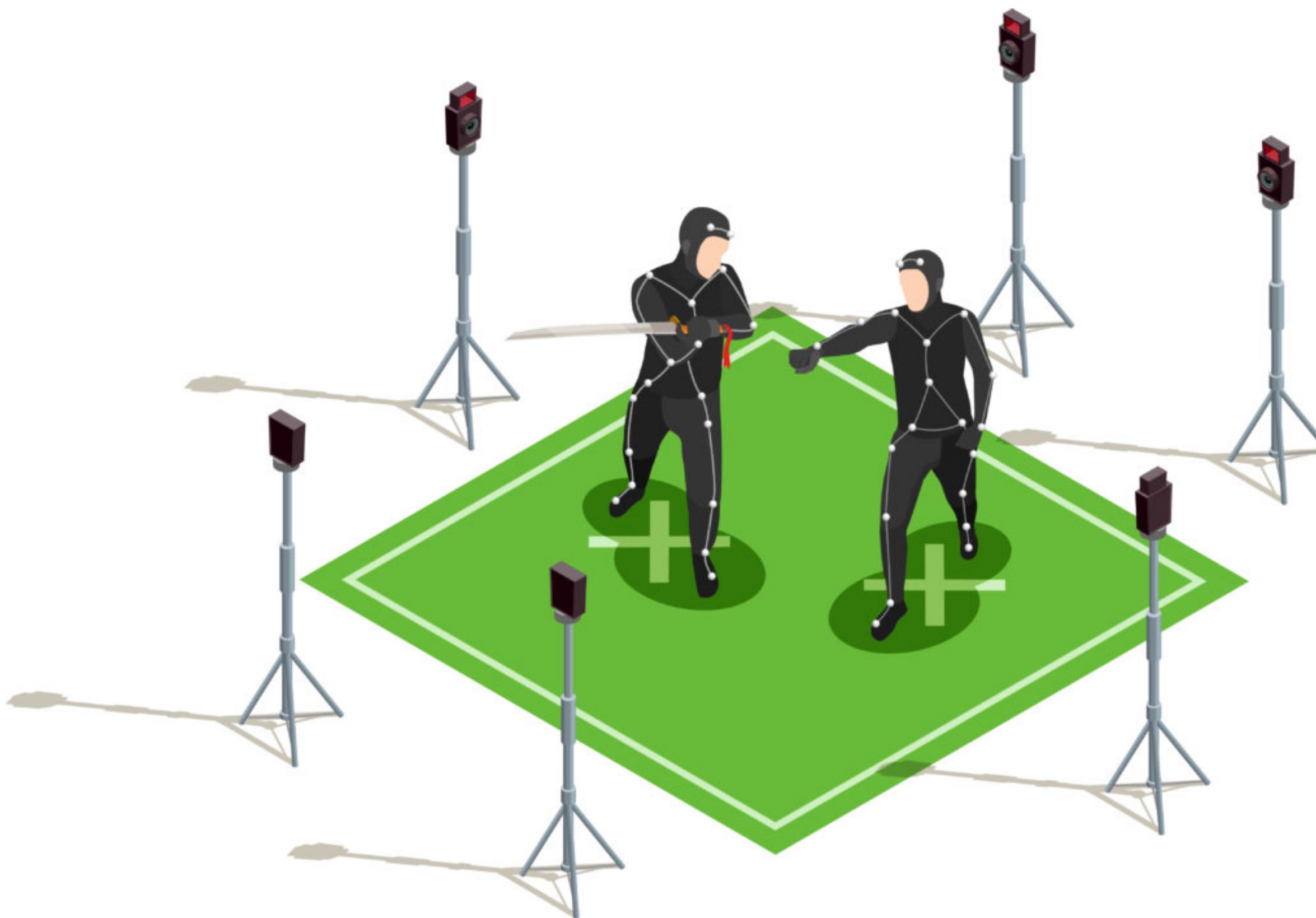
But human is lazy, so they create tools

# Method 2 - Motion Capture

For the positions of each joint, we can capture them on real human



# Method 2 - Motion Capture



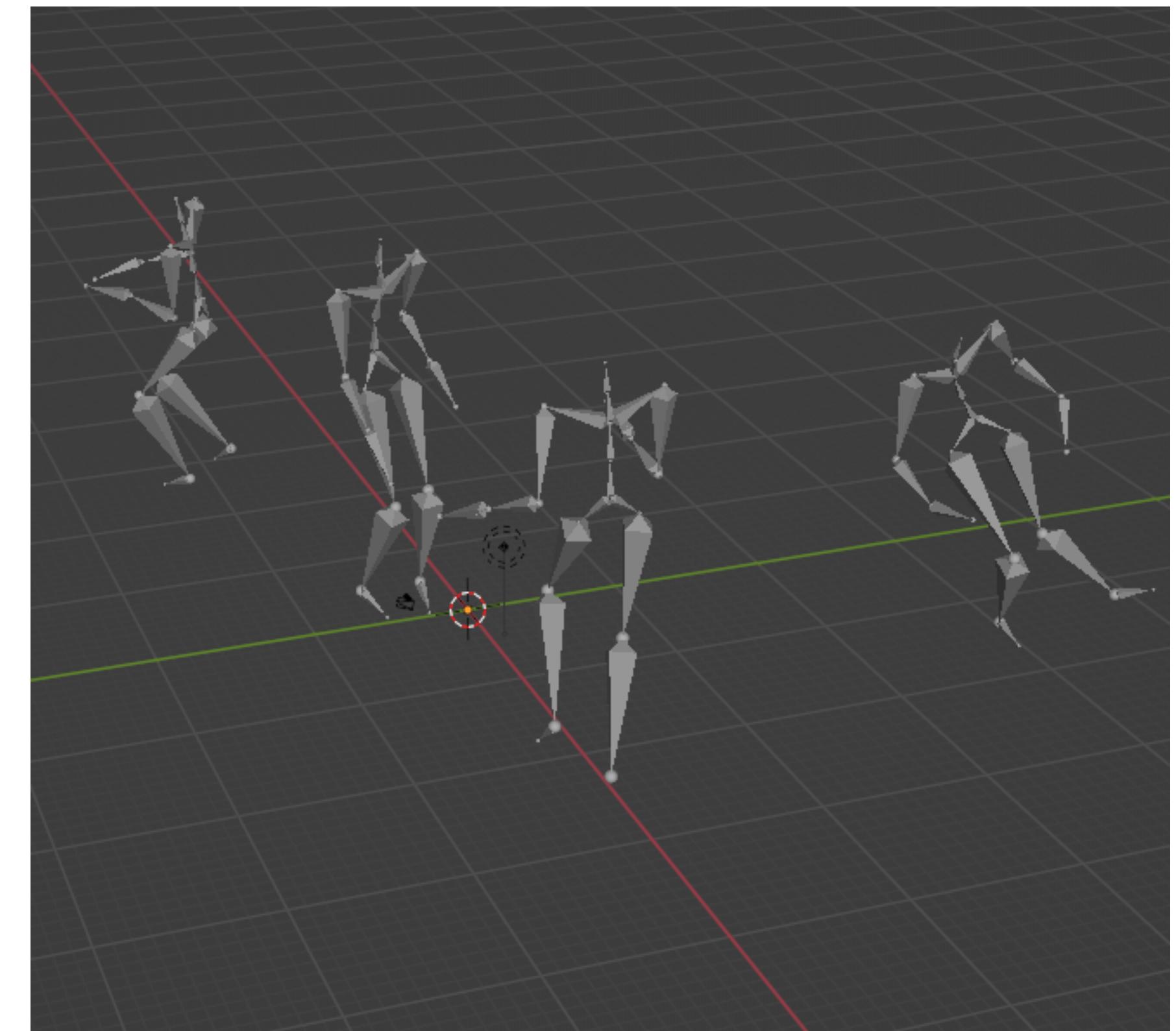
1. Lots of calibrated cameras
2. Lots of markers on performer
3. Professional software

# Method 2 - Motion Capture

The motion file will be stored in BVH (Biovision Hierarchy) file

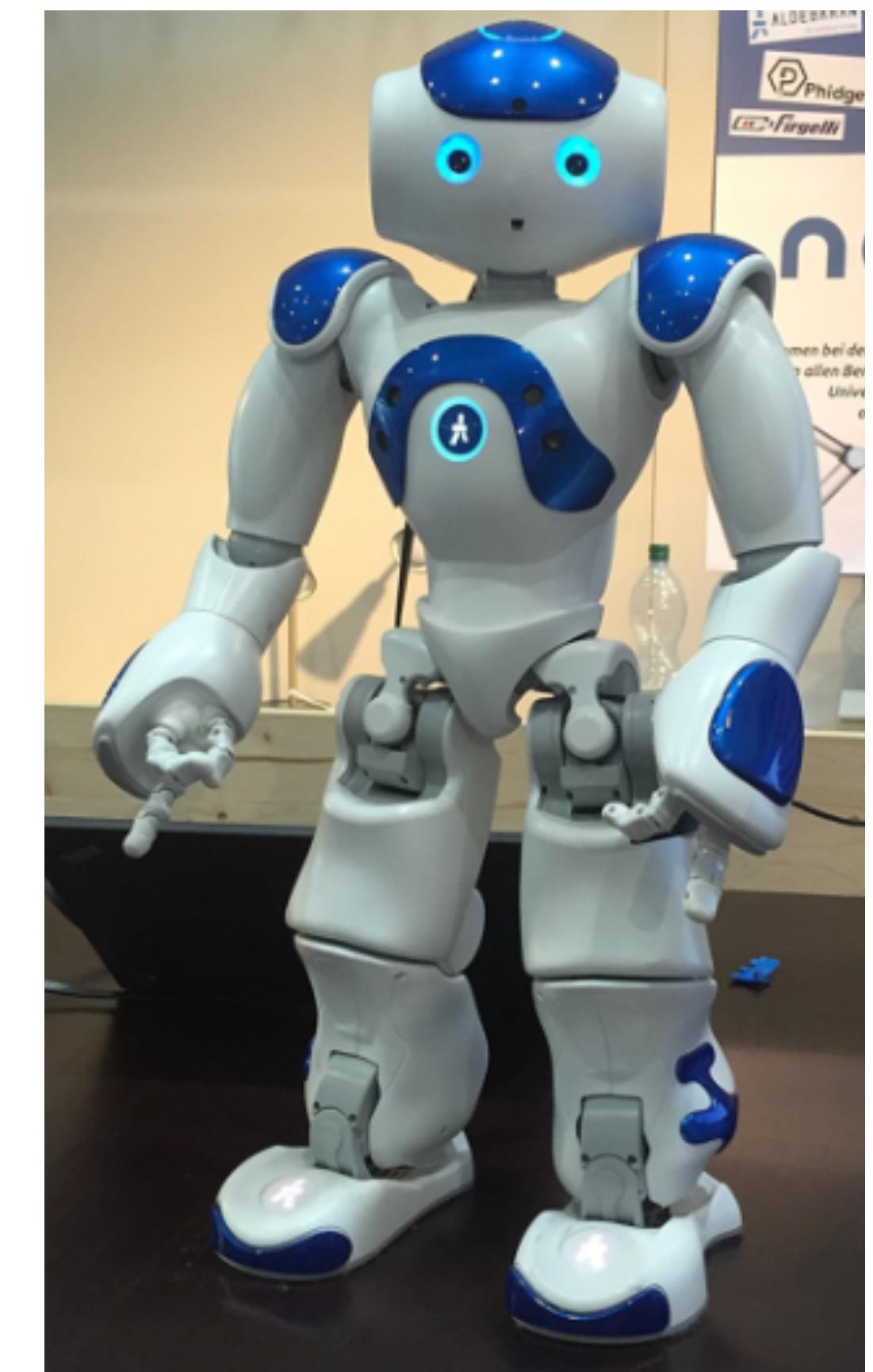
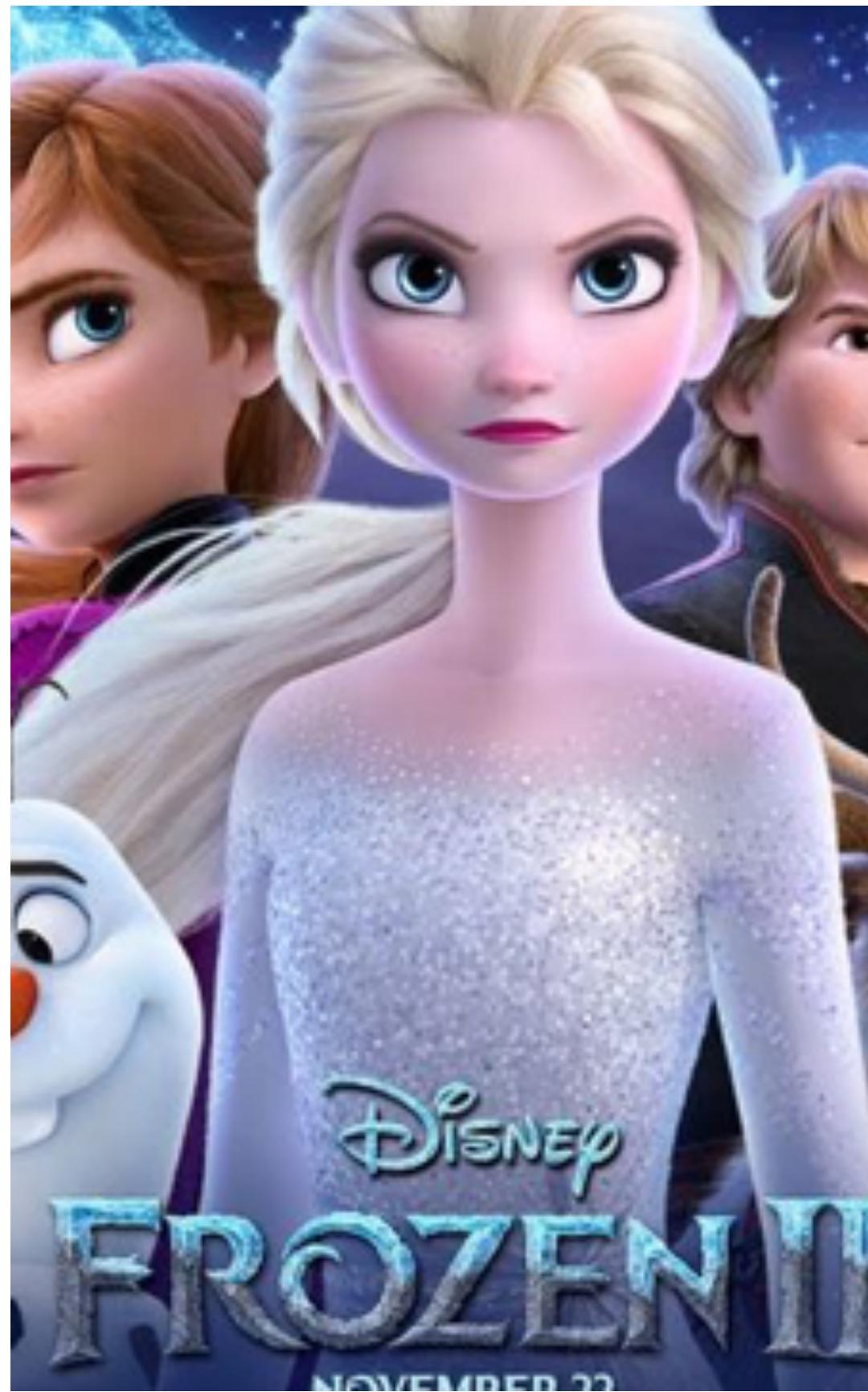
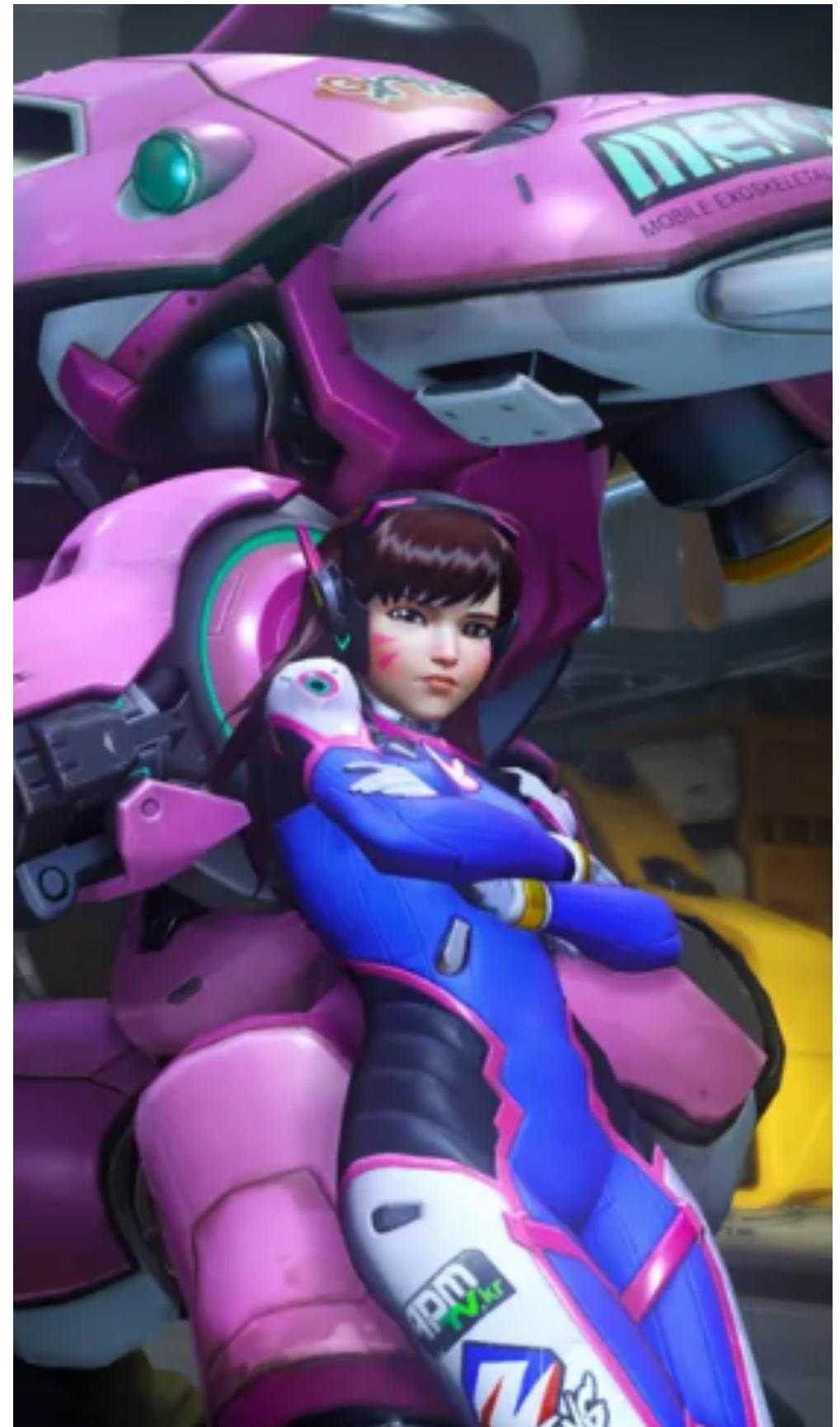
\* Think about how to understand it with coding

```
HIERARCHY
ROOT Hips
{
    OFFSET 0 0 0
    CHANNELS 6 Xposition Yposition Zposition Zrotation Xrotation Yrotation
    JOINT LeftHip
    {
        OFFSET 3.5 0 0
        CHANNELS 3 Zrotation Xrotation Yrotation
        JOINT LeftKnee
        {
            OFFSET 0 -19.0555 0
            CHANNELS 3 Zrotation Xrotation Yrotation
            JOINT LeftHeel
            {
                OFFSET 0 -21.1464 0
                CHANNELS 3 Zrotation Xrotation Yrotation
                End Site
                {
                    OFFSET 0 0 9.64661
                }
            }
        }
    }
}
```



Example File: bvhs.blend

# Review these arts



Motion Capture  
K-frame

Real time face landmark detection

Imitation study

# Quiz 1 - Play with Character Animation (15% for assignment 1)

1. Download Blender
2. Import the provided FBX file and check the mesh (./data/angry\_girl.fbx)
3. Open provides blender file to check the content
  - ***skeleton\_in\_mesh.blend***
  - ***rig\_body\_blocks.blend*** and ***rig\_body\_mesh.blend***
  - ***animation\_keyframe.blend*** and ***animation\_bvhs.blend***
4. Create a keyframe animation with ***exercise\_k\_frame.blend*** and render it to a video (don't require animation quality)
5. Open bvh files with text editor and check the structure, how many numbers in the second part and what does it represent?

Resources: [https://github.com/Shimingyi/COMP3360\\_Data\\_Driven\\_Animation](https://github.com/Shimingyi/COMP3360_Data_Driven_Animation)

# Blender Tips

- A new version will be welcomed (blender 3.0)
- It's a free software so download the official version pls

Know the operations:

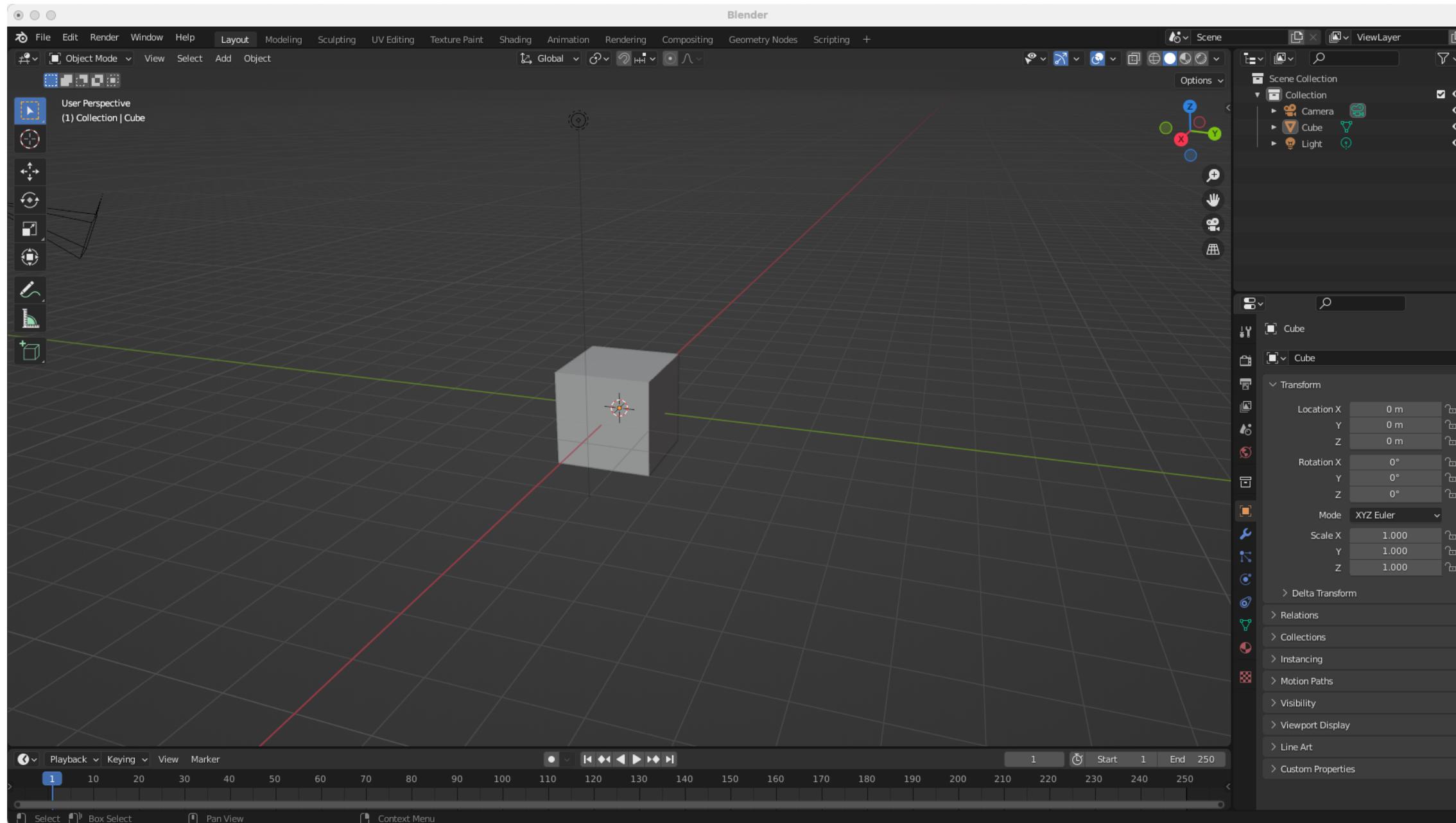
Viewpoint Navigation - <https://www.youtube.com/watch?v=ILqOWe3zAbk>

Add/delete Object - <https://www.youtube.com/watch?v=JSAobQPRLwc>

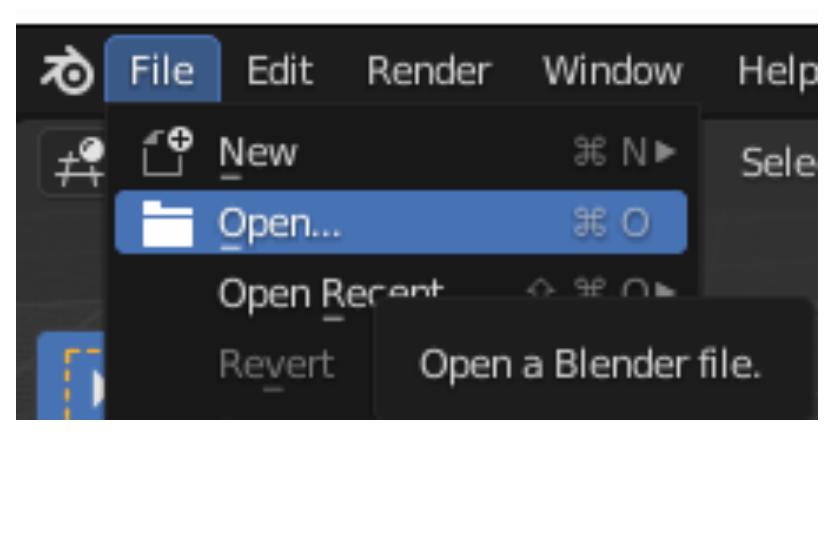
and google more if you need

# Example - with exercise file

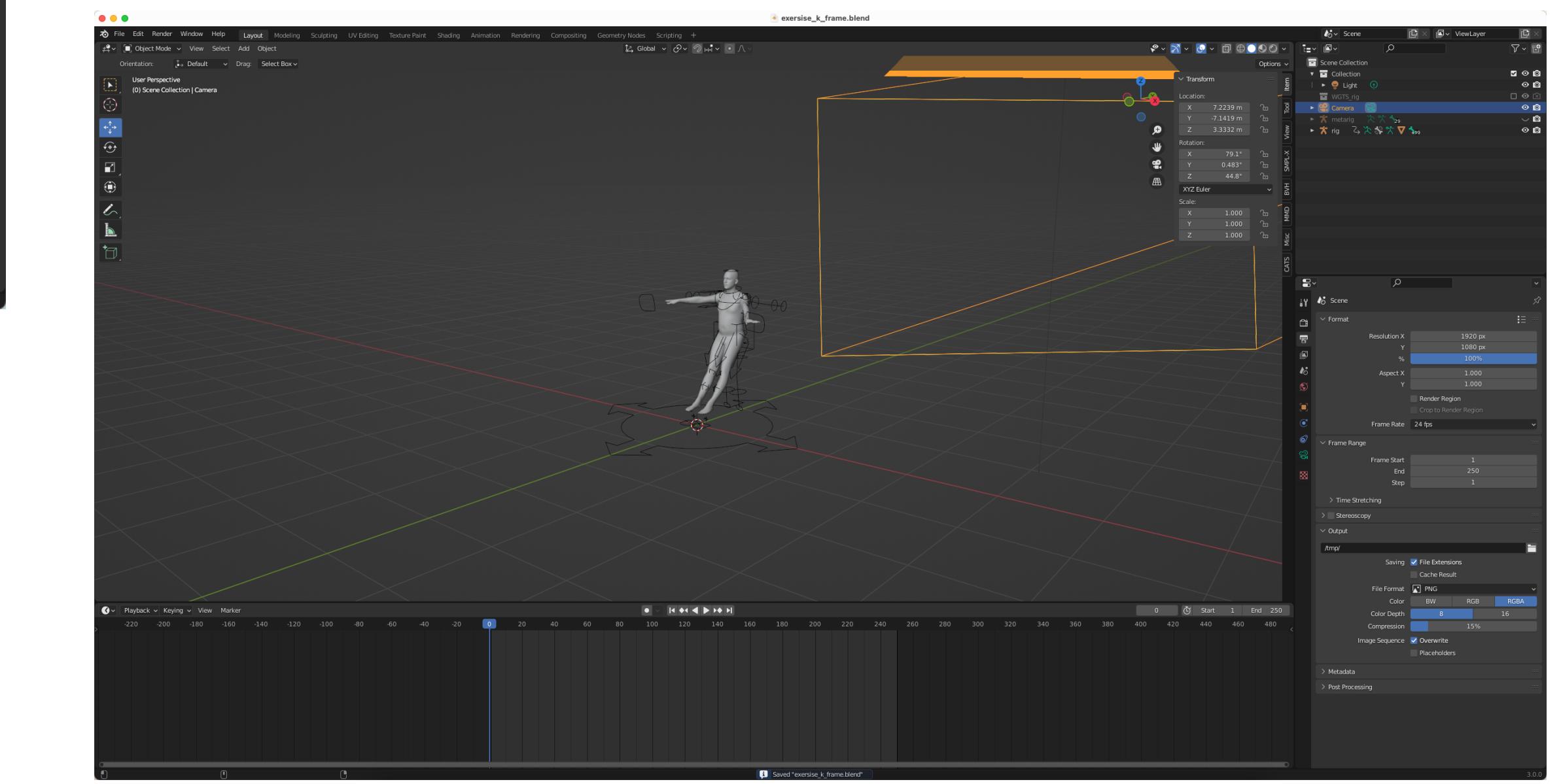
Open software:



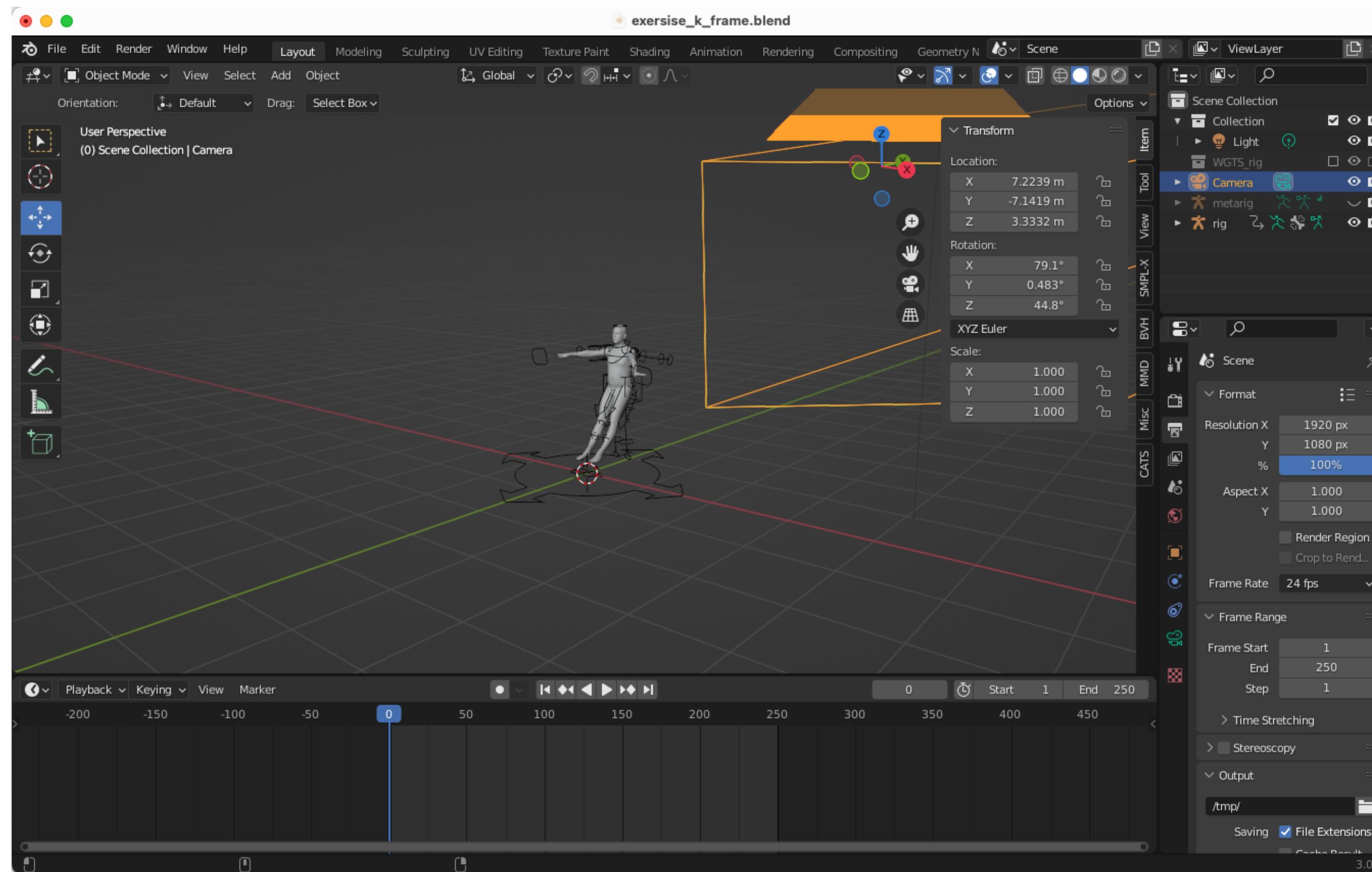
File menu



Choose this file



# Example - with exercise file



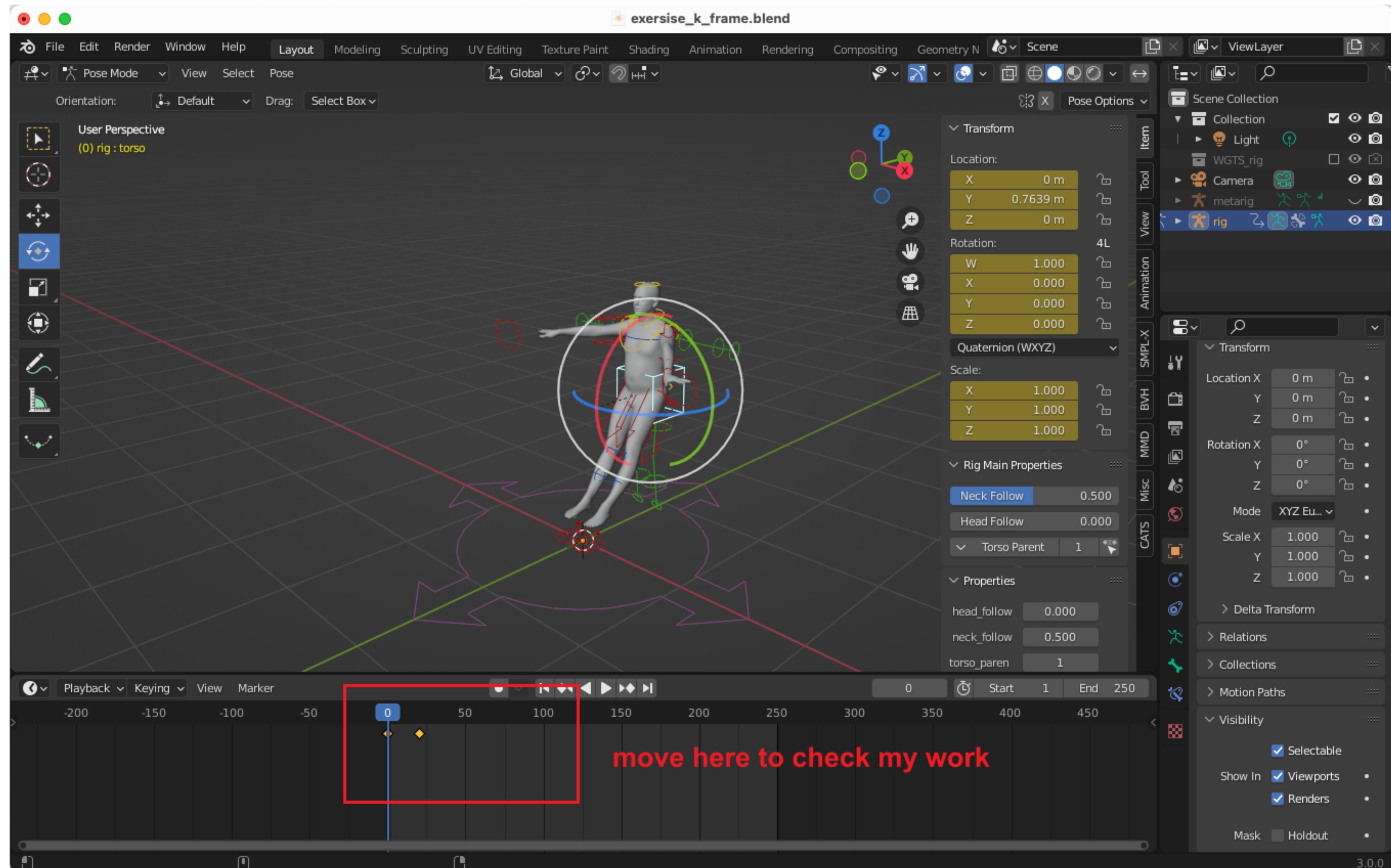
Right top: Scene objects

Right bottom: Properties

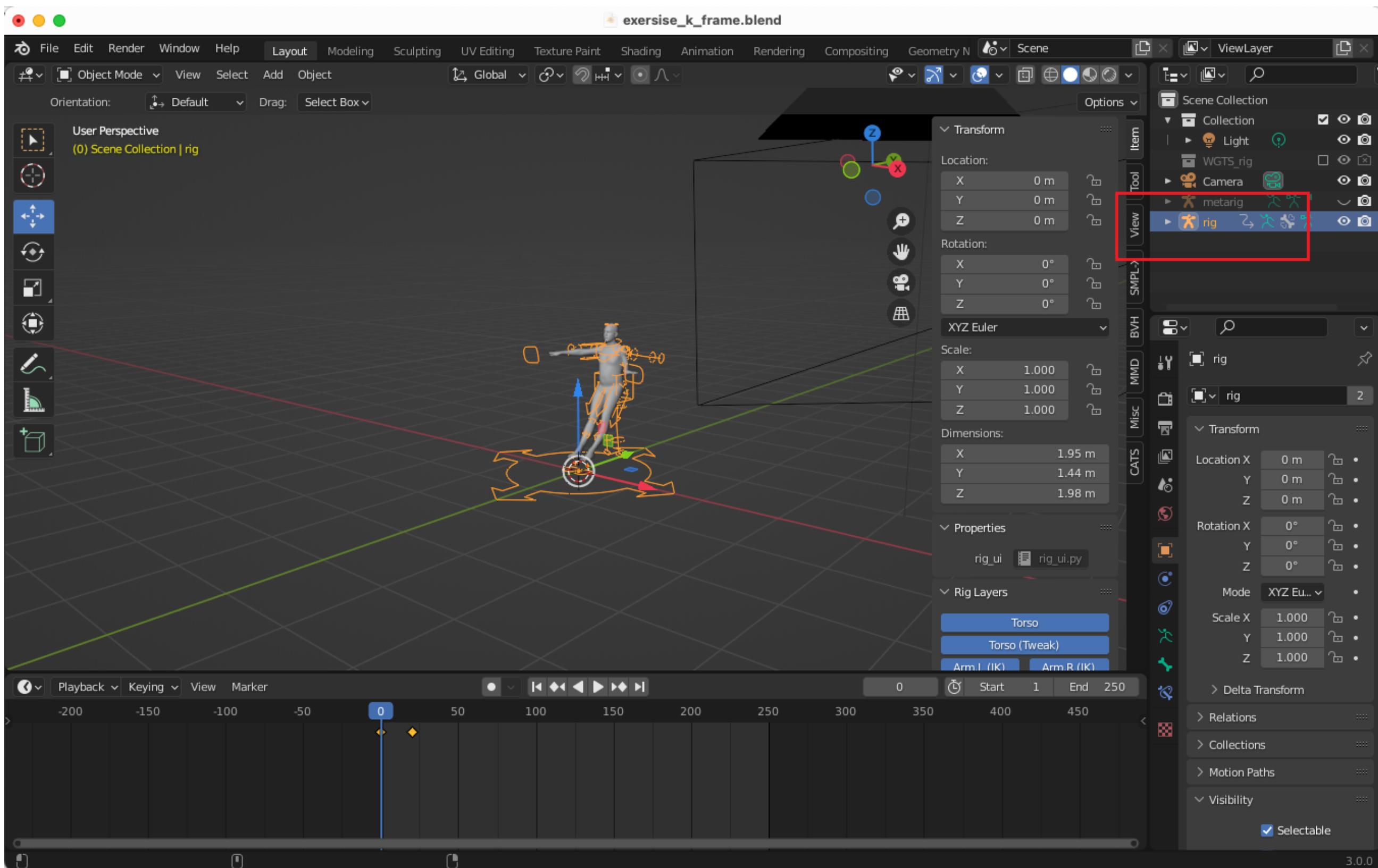
Main panel: Scene

Bottom: timeline

# Example - with exercise file

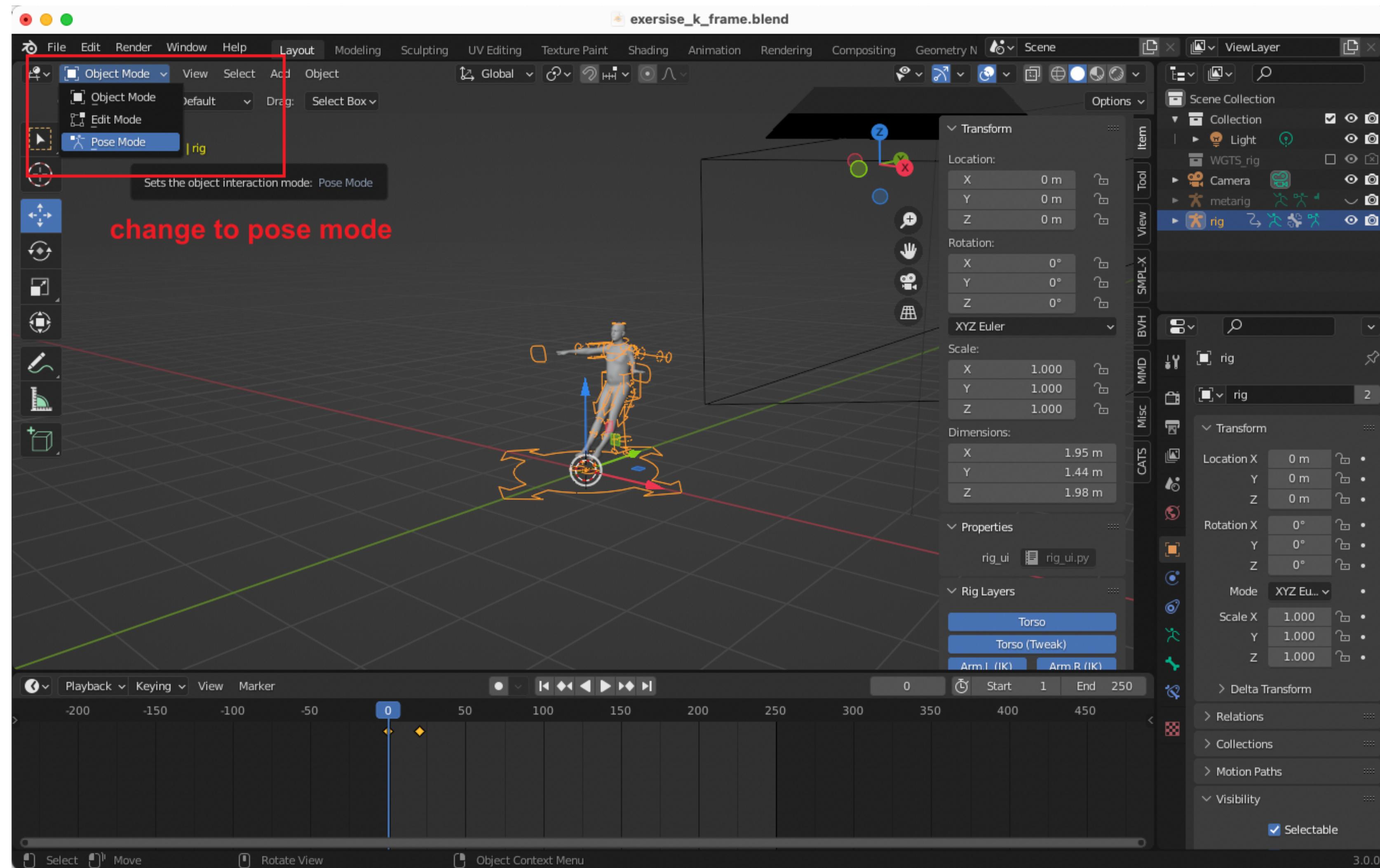


# Example - with exercise file

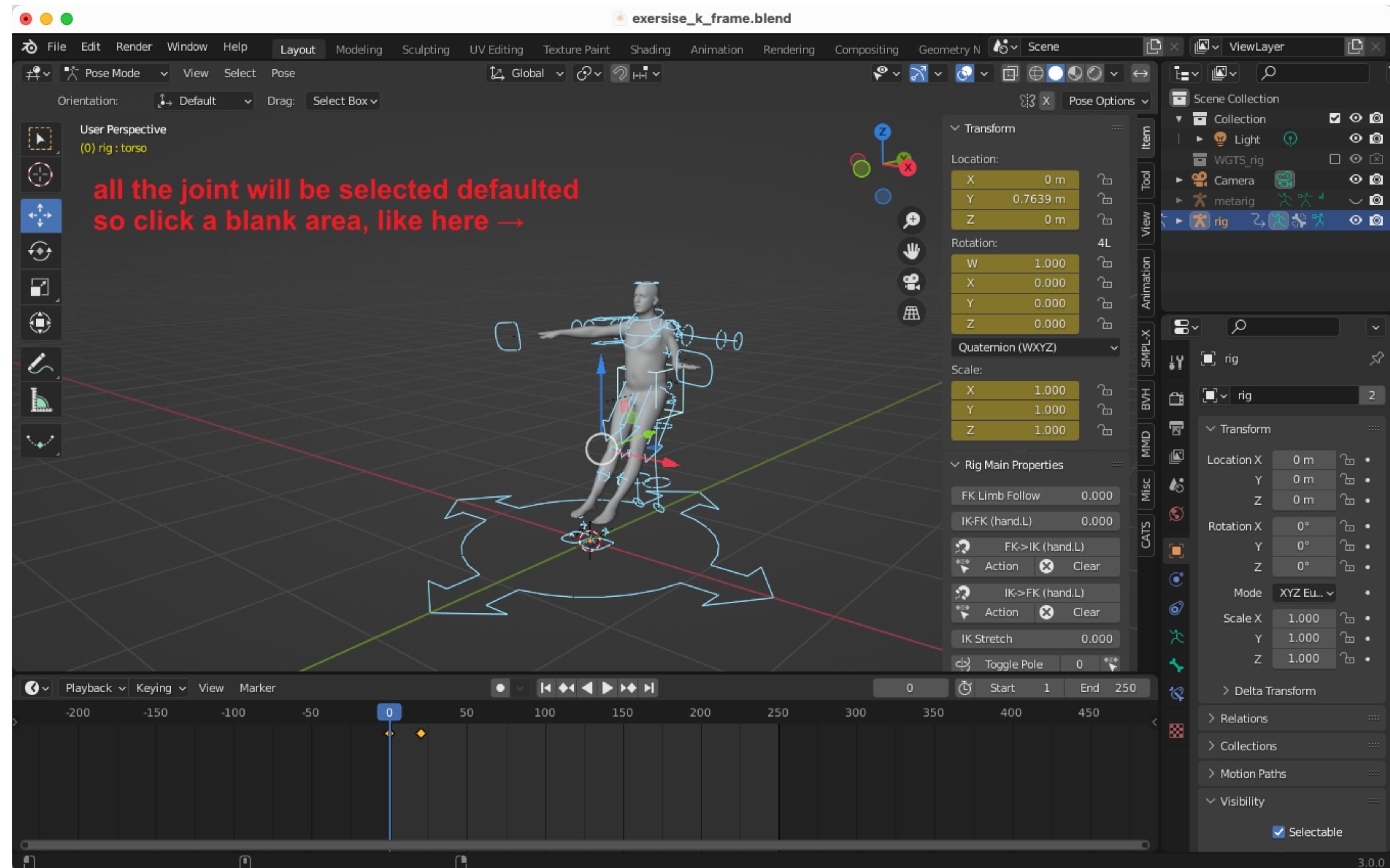


Click the ***rig*** object in right panel to select the main object we will manipulate

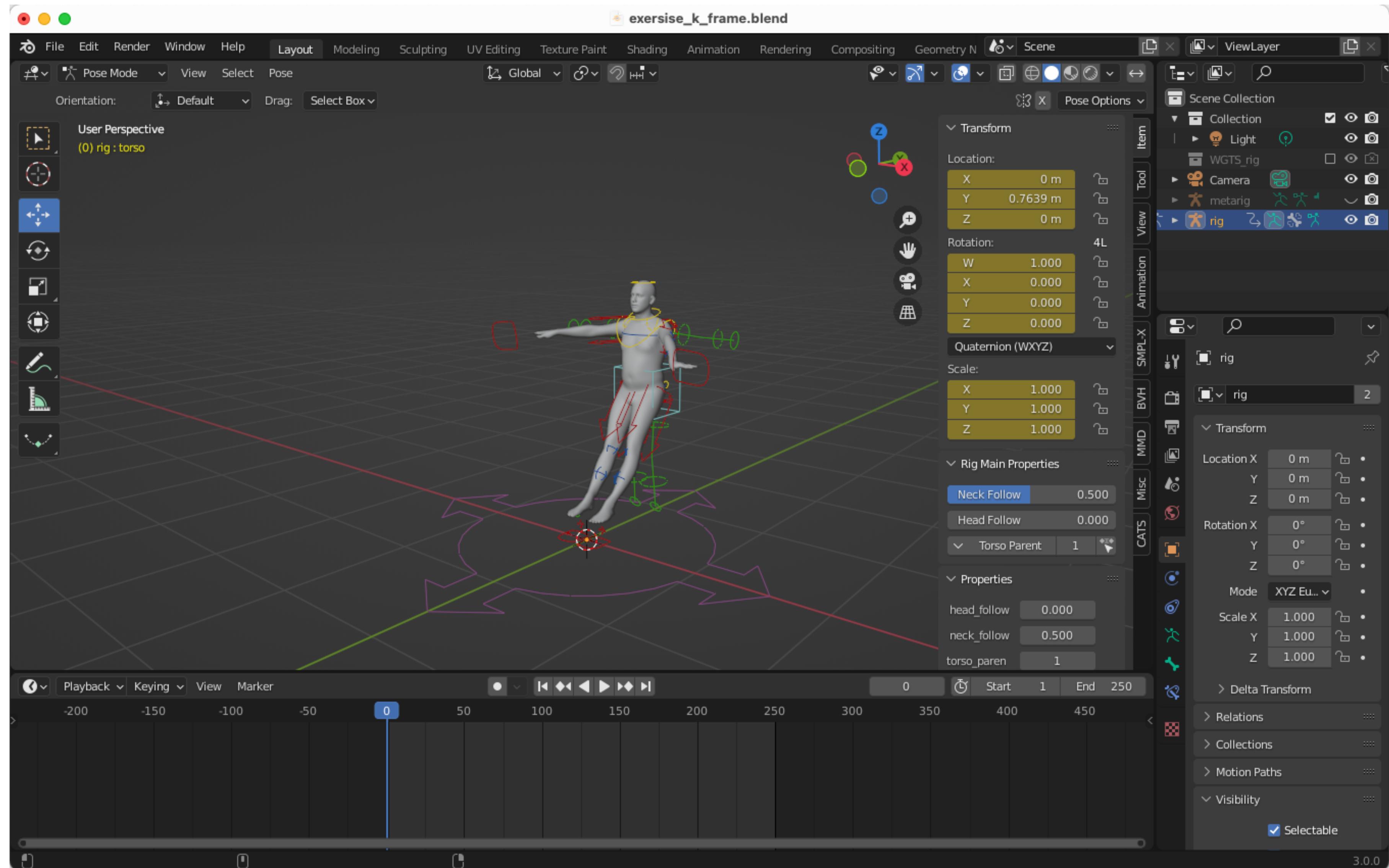
# Example - with exercise file



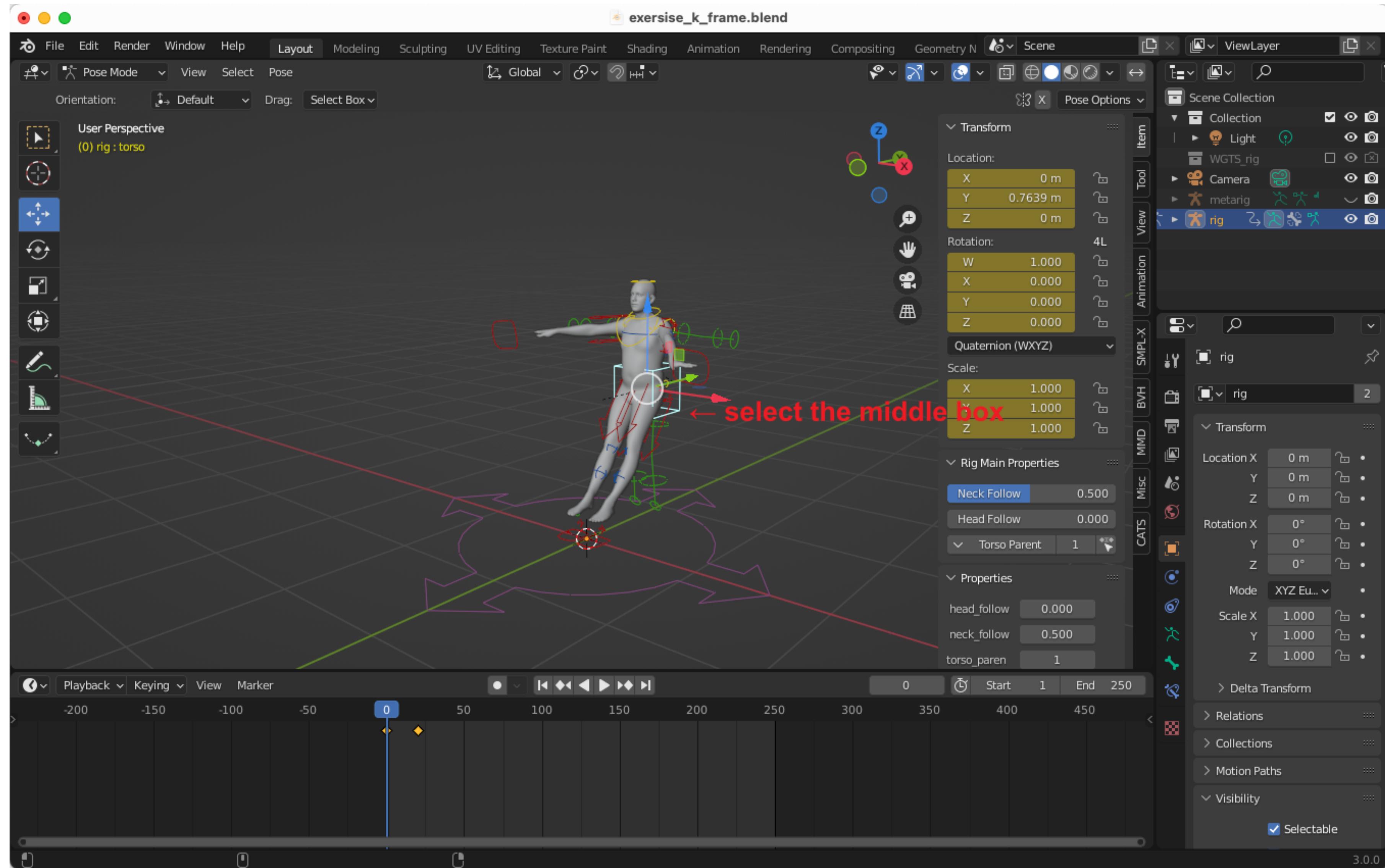
# Example - with exercise file



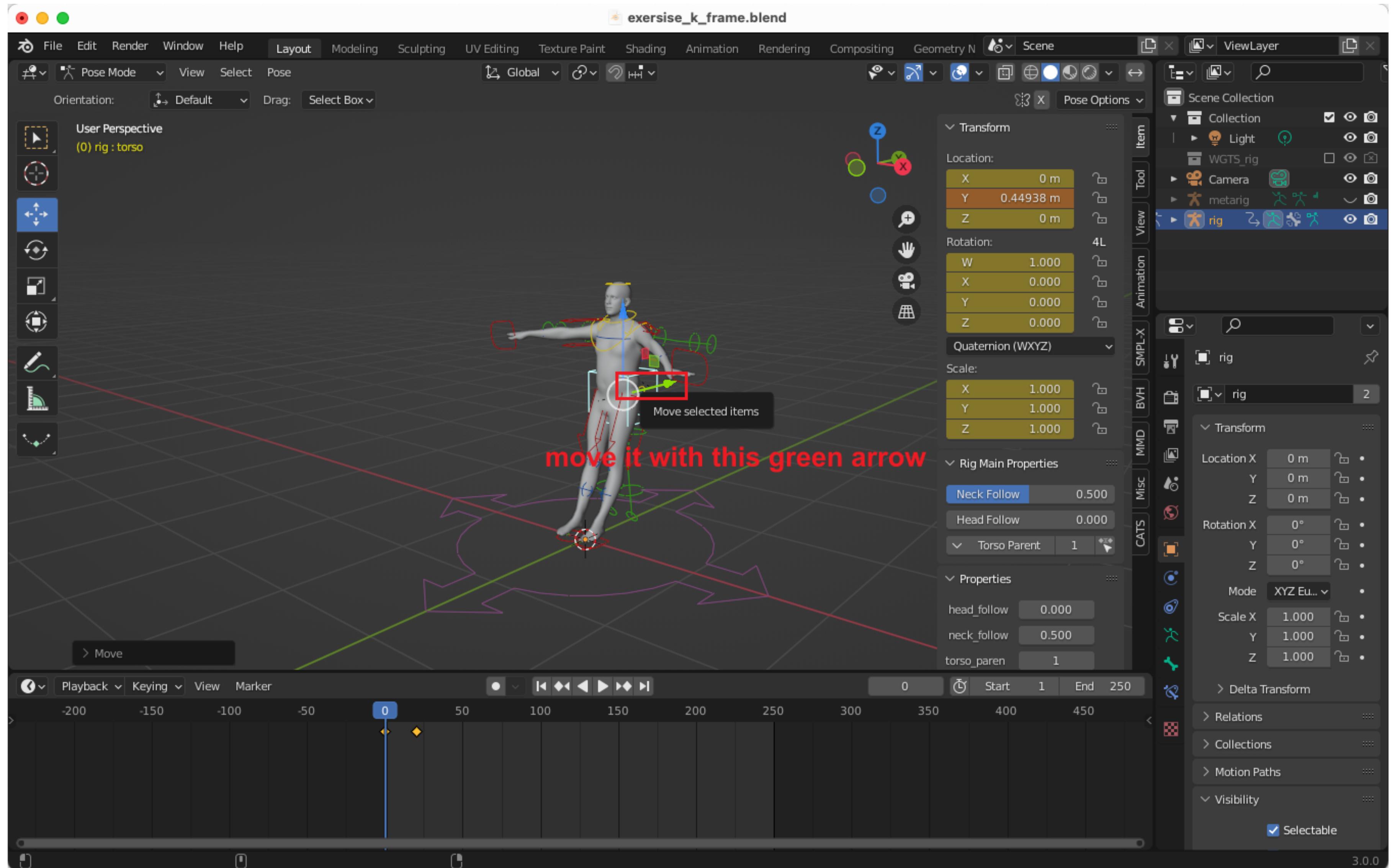
# Example - with exercise file



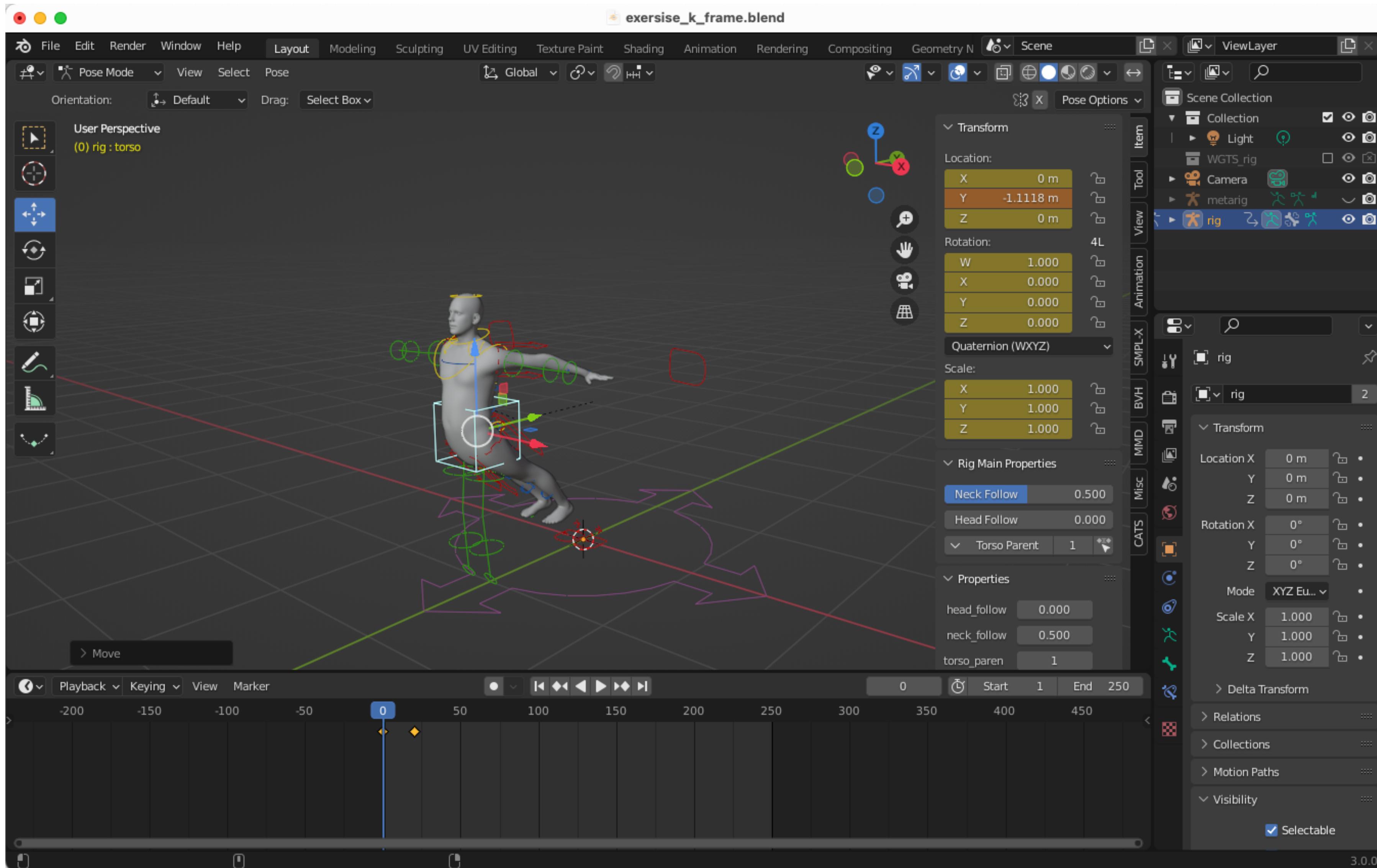
# Example - with exercise file



# Example - with exercise file



# Example - with exercise file

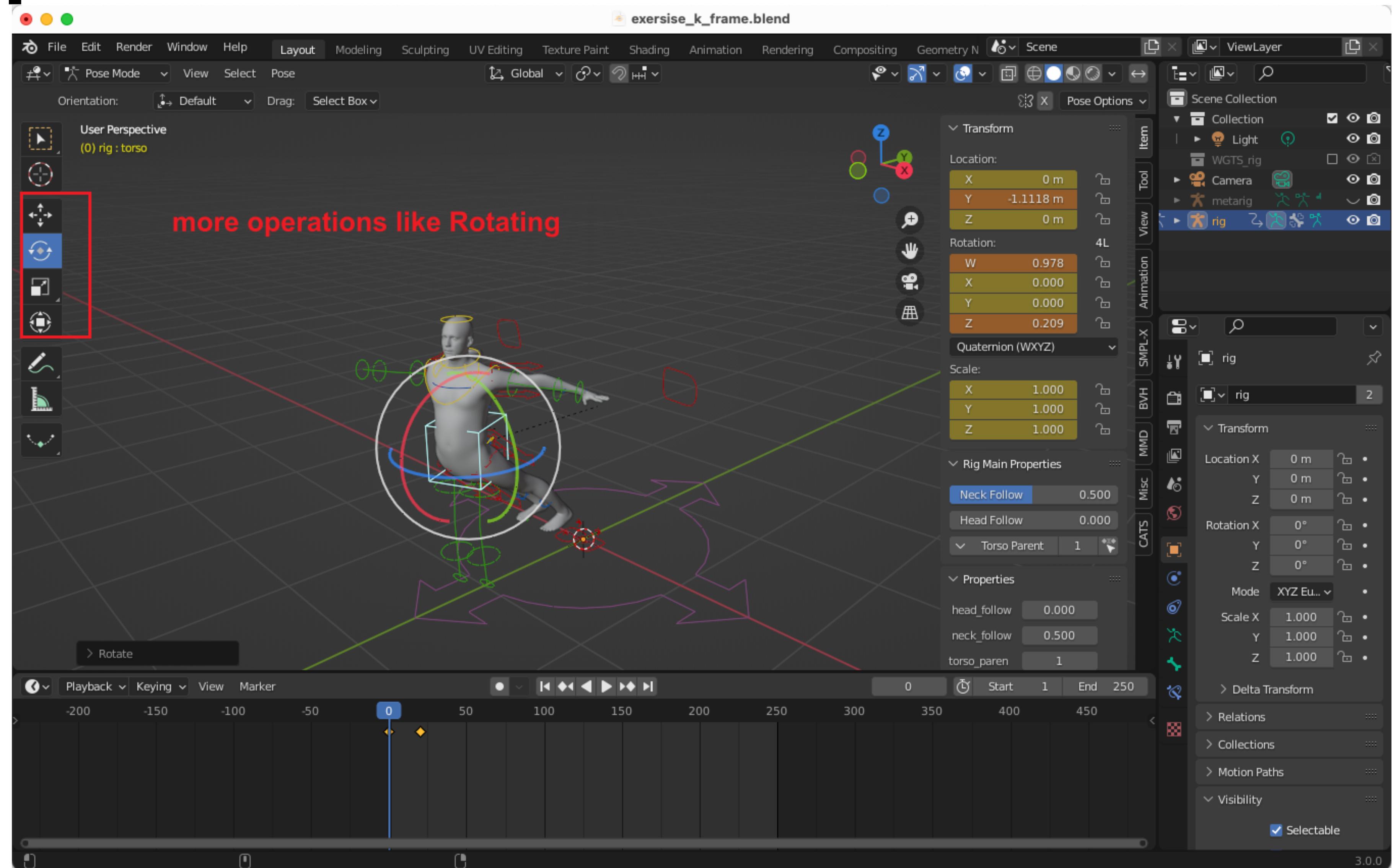


Then it moved

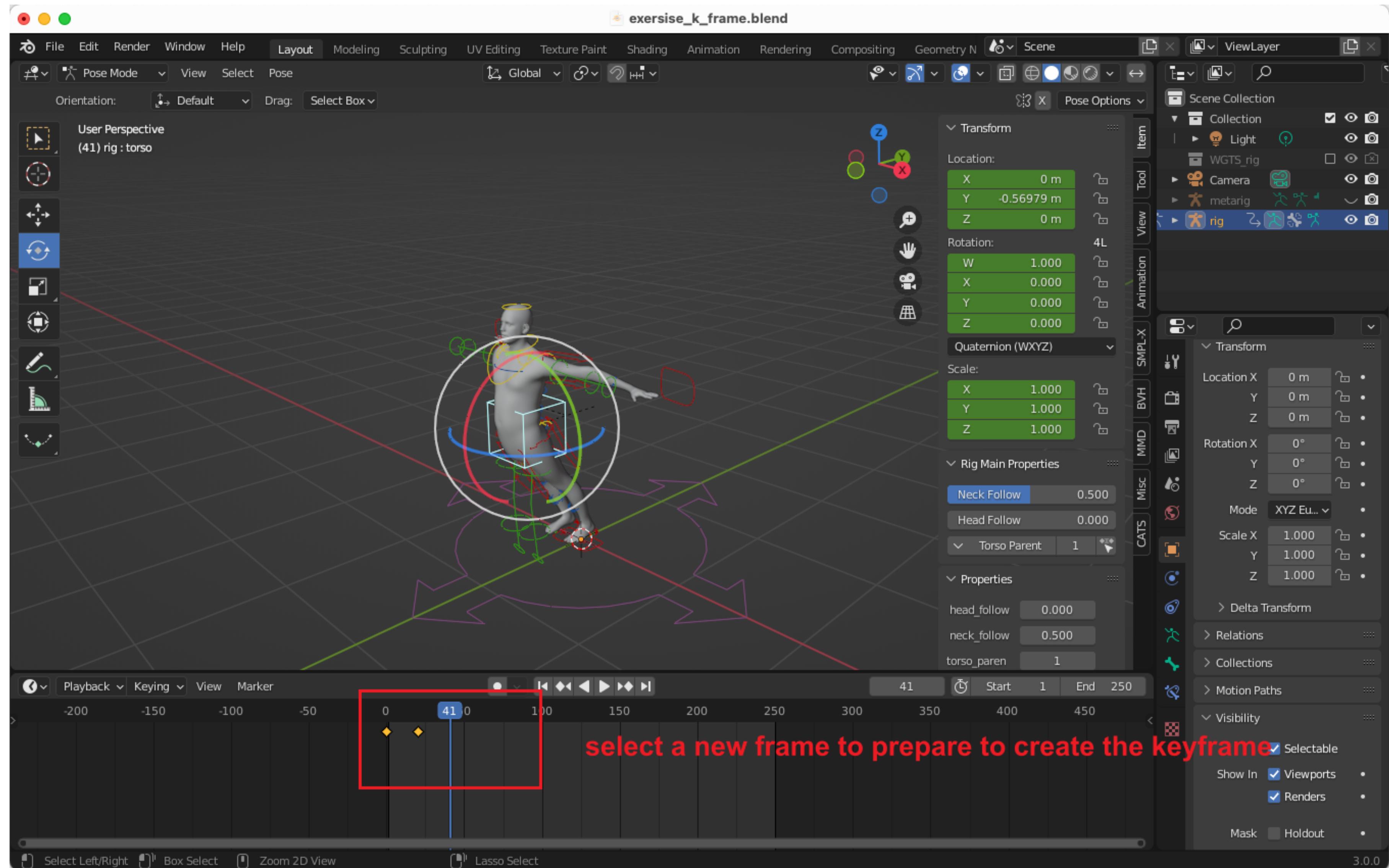
The whole body will be moved because the IK tech is used here. Observe the build-in IK because you are required to implement one in next assignment

If you want to change other joint, select its boundary box

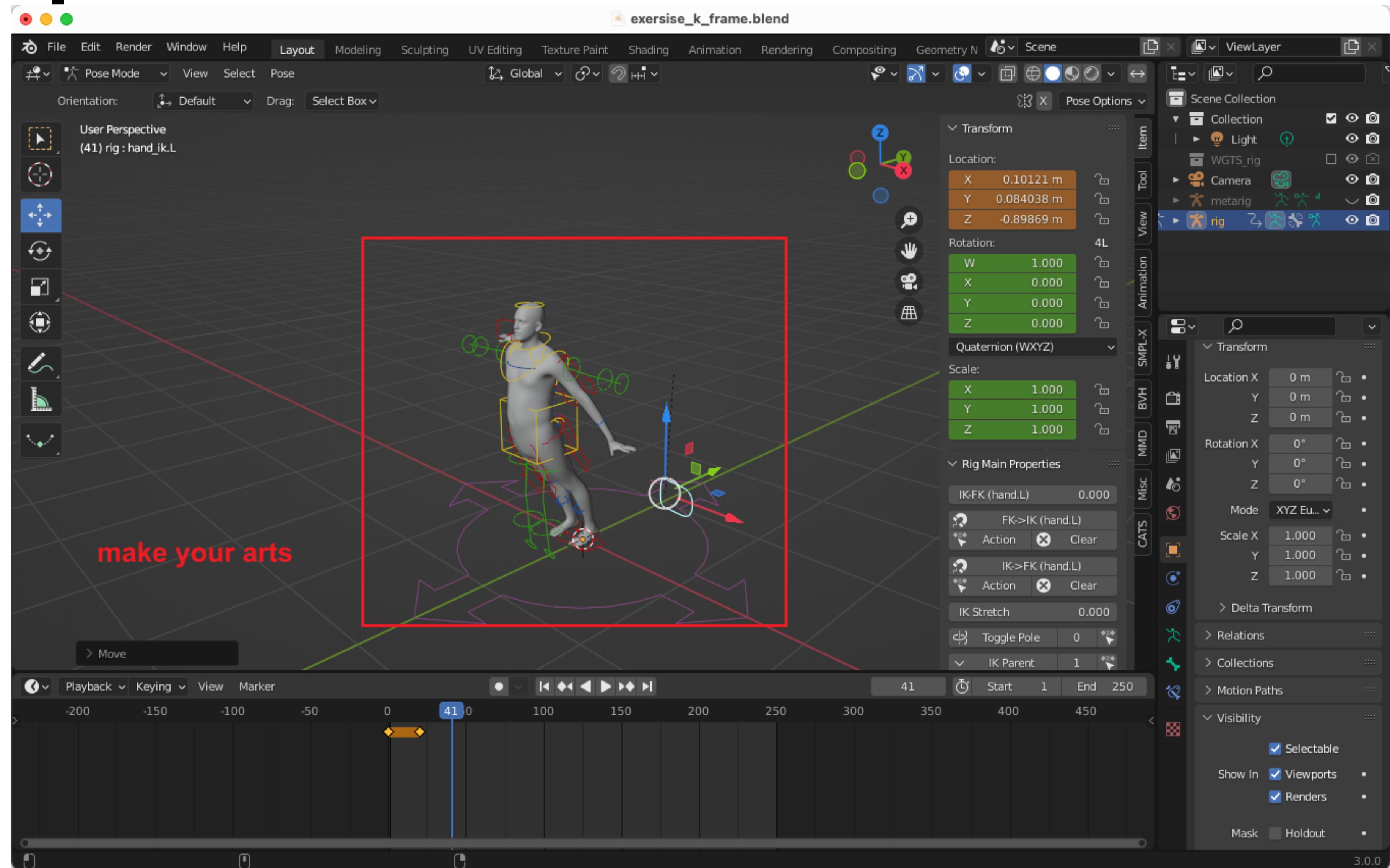
# Example - with exercise file



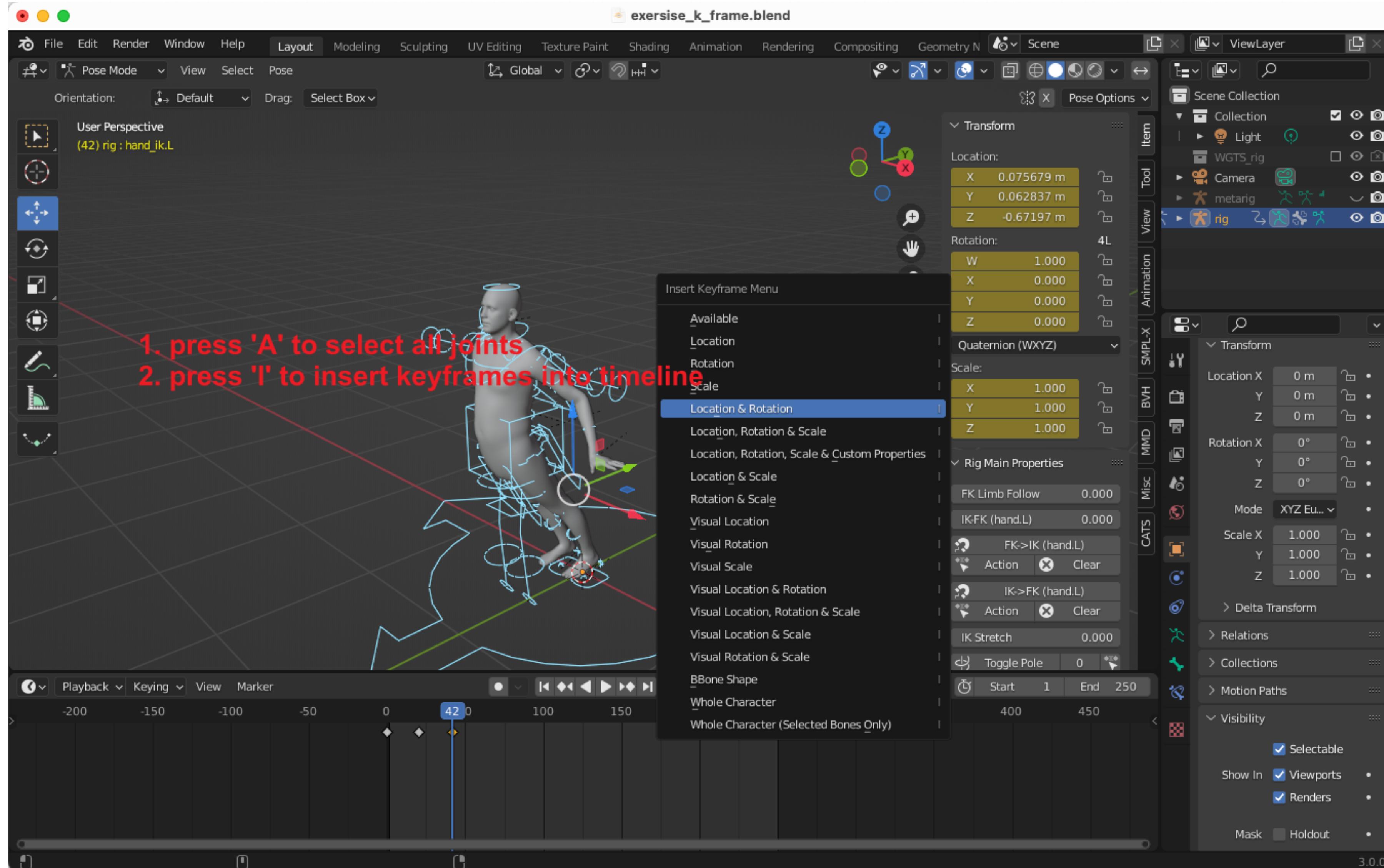
# Example - with exercise file



# Example - with exercise file

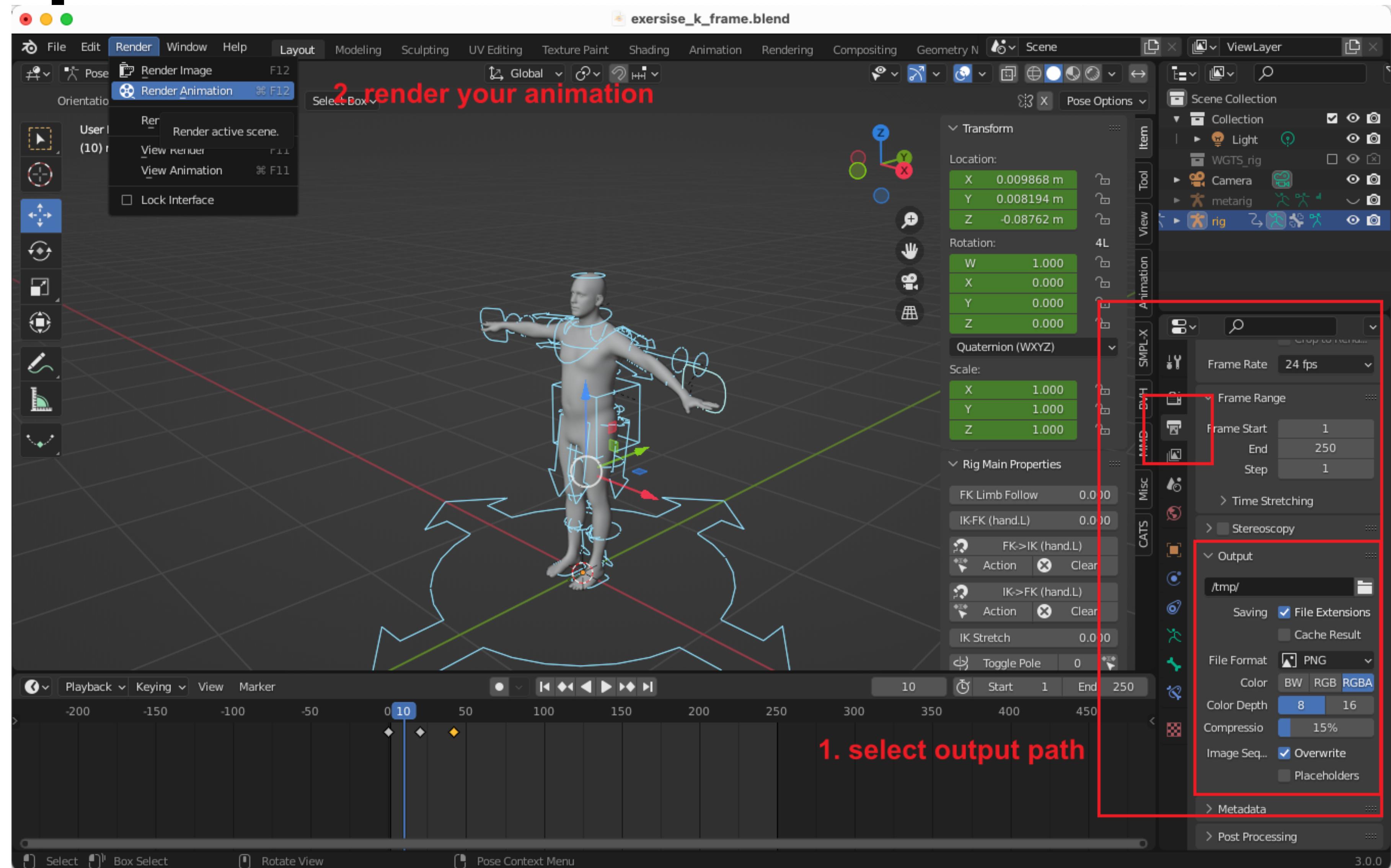


# Example - with exercise file

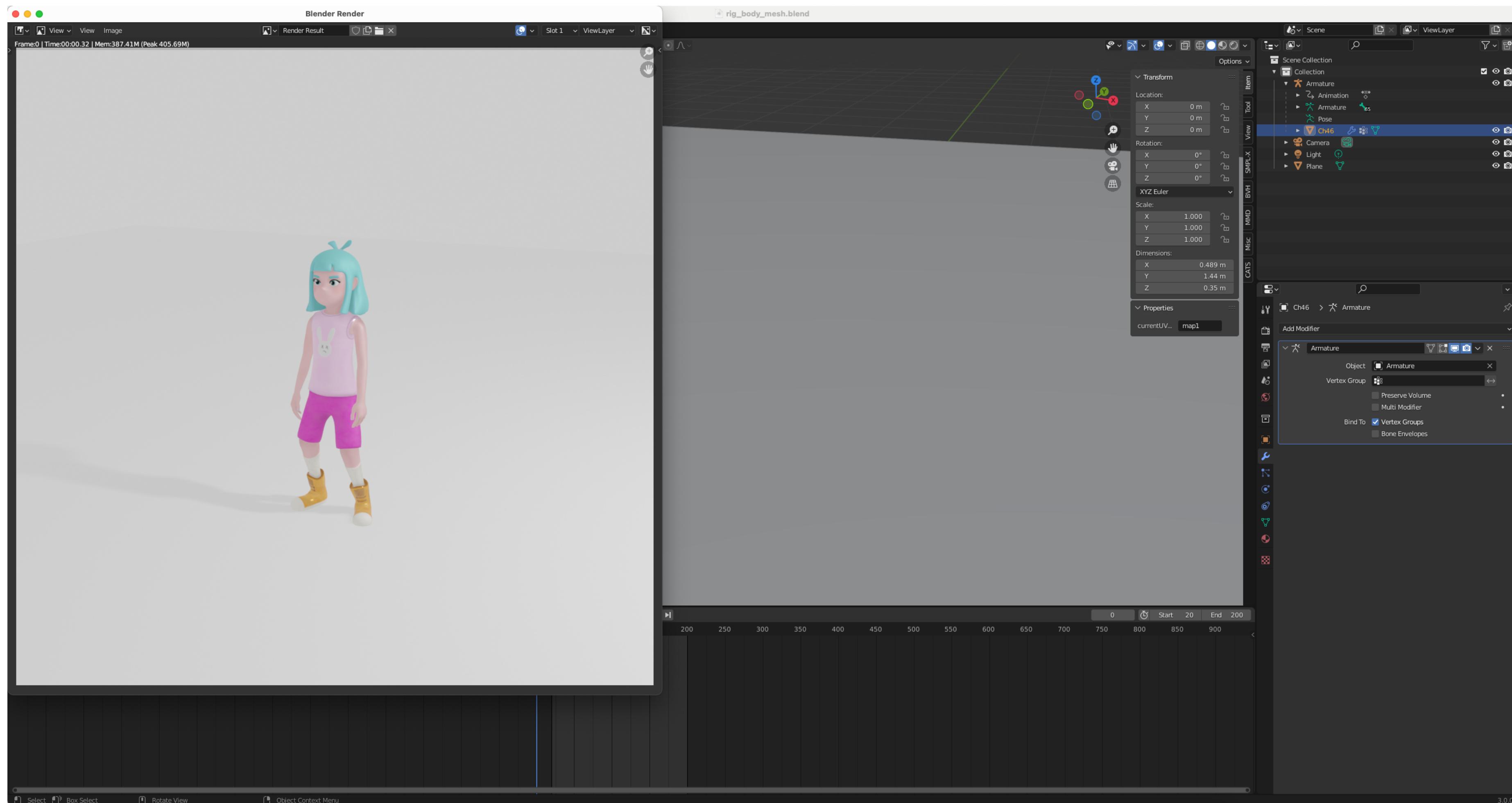


Then check your arts by drag the timeline cursor

# Example - with exercise file



# Example - with exercise file



rig\_body\_mesh.blend  
can get a much better rendering