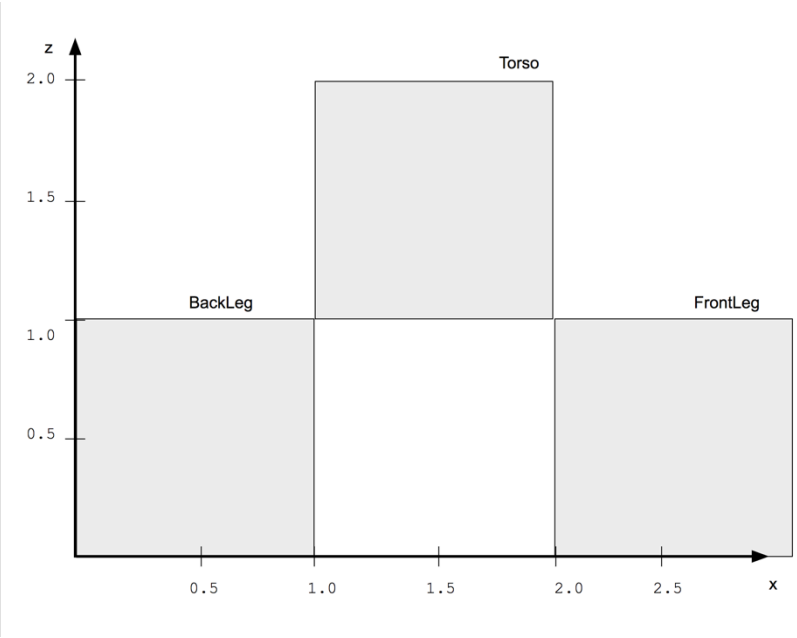
Using Blender to Obtain Relative Coordinates

In r/ludobots [E. Joints] we're introduced to the following example to create a three-link two-joint robot in pybullet.

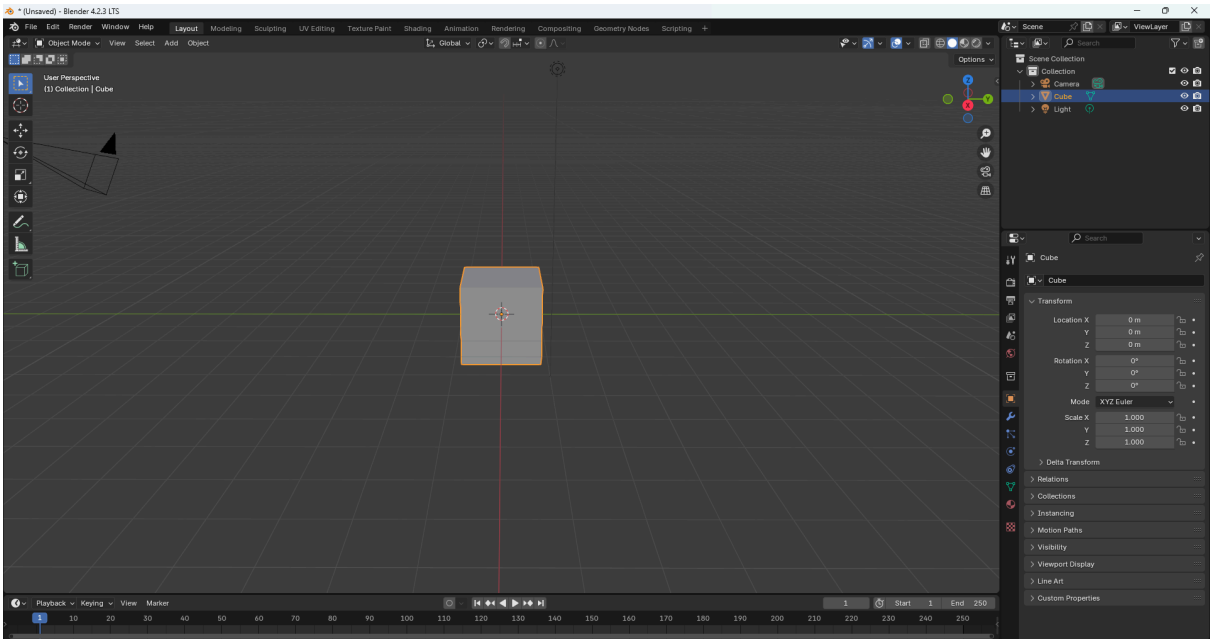


The position of FrontLeg and BackLeg need to be set using relative coordinates, or their position relative to Torso. If you're having a hard time mapping out the coordinates mathematically or in your head, you can use the 3D-modelling program Blender to create these coordinates for you.

In this guide, we will recreate the example in Blender, and use parent-child relationships to generate relative coordinates.

1. Blender is a free open source 3D modelling program, which can be installed via https://www.blender.org/download/. Donations are not required for use. Blender can get very complicated very quickly, this guide will only go into the very basics. Save often, as Blender does not feature auto-saving.

2. When you open Blender for the first time, it will create a blank file with a (2,2,2) cube mesh located at (0,0,0). A selected mesh will have an orange border around it.

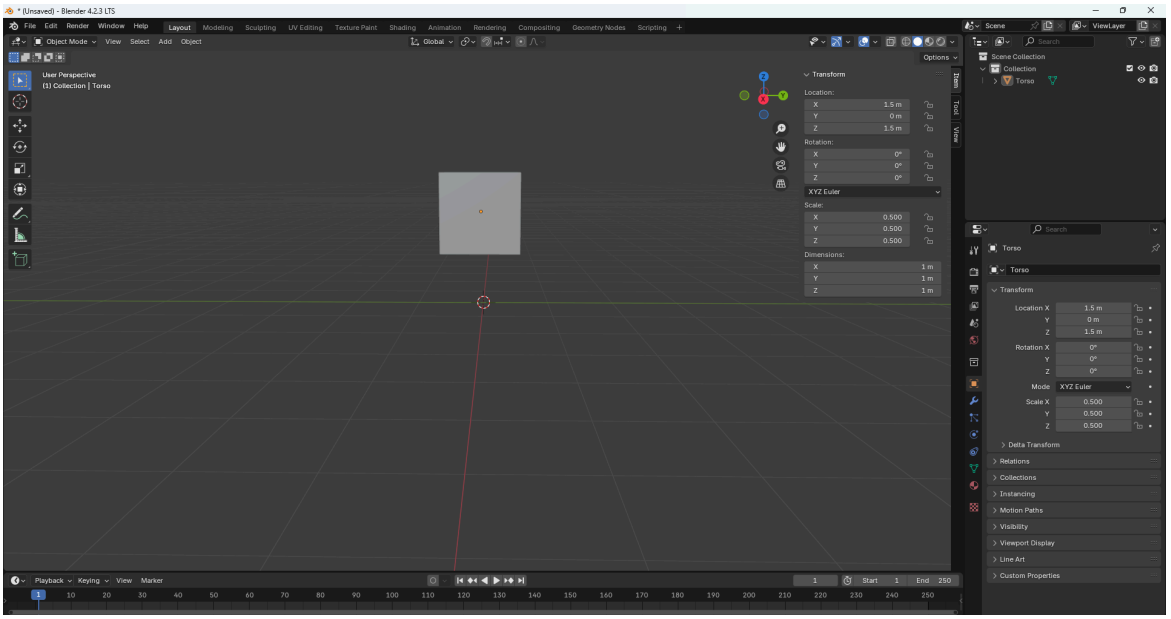


Important to note are

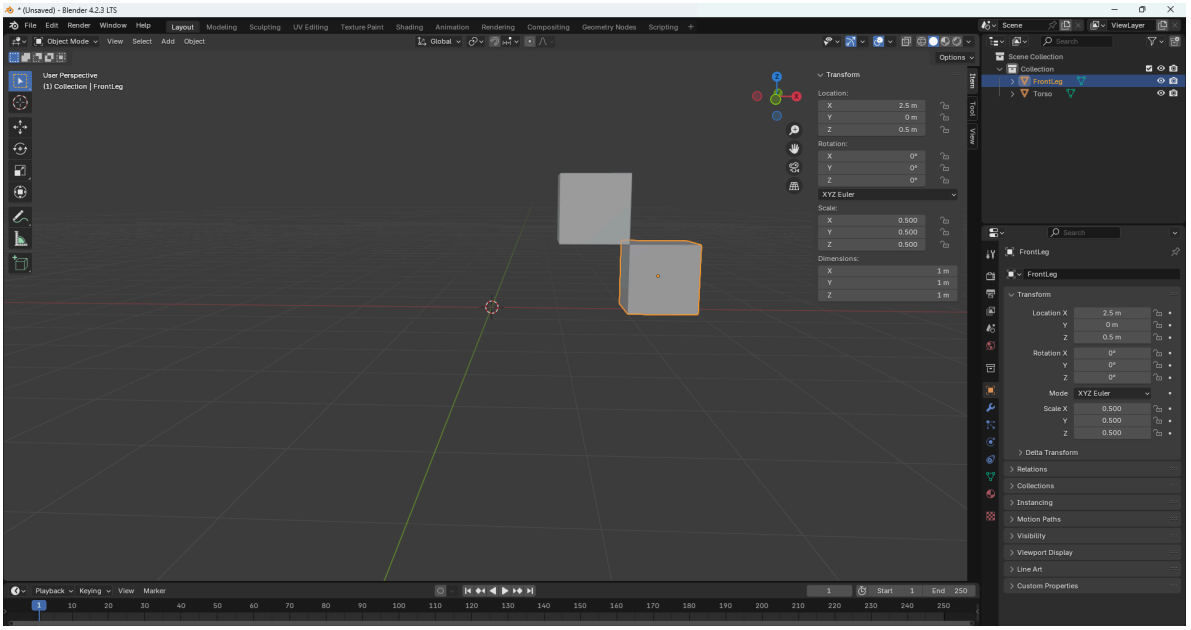
- Scene Collection
    - The Scene Collection lists all of the objects located in your scene. Blender will automatically add a camera and a light into your scene, which is unnecessary for our purposes. You can delete objects by right clicking on the object name in Scene Collection, and then pressing delete in the menu. The delete button on your keyboard will not work.
- Properties Editor
    - Located beneath Scene Collection. We don't need the properties editor for our purposes either, unless you want to change the color of the object, which for our use can be done using Material -> Viewport Display -> Color. You may be tempted to change the size using scale, but refrain from that for now.
- Viewpoint angle
    - The viewpoint angle can be adjusted using the multicolored axis at the top of the screen, by either clicking or dragging.
- Transformation editor
    - If you press n on your keyboard, you'll open the transformation editor, this is the superior editor for our purposes, as you'll notice it features both scale and dimensions.

3. We'll start by editing the cube mesh Blender gave us. Change the dimensions of the mesh to (1,1,1) in the transformation editor. You'll notice the scale will change as well, which is why we don't want to edit the size using only scale. It's helpful to change the name of the mesh, which can be done by double-clicking on the mesh name under Scene Collection. This mesh will become our Torso link for our robot.

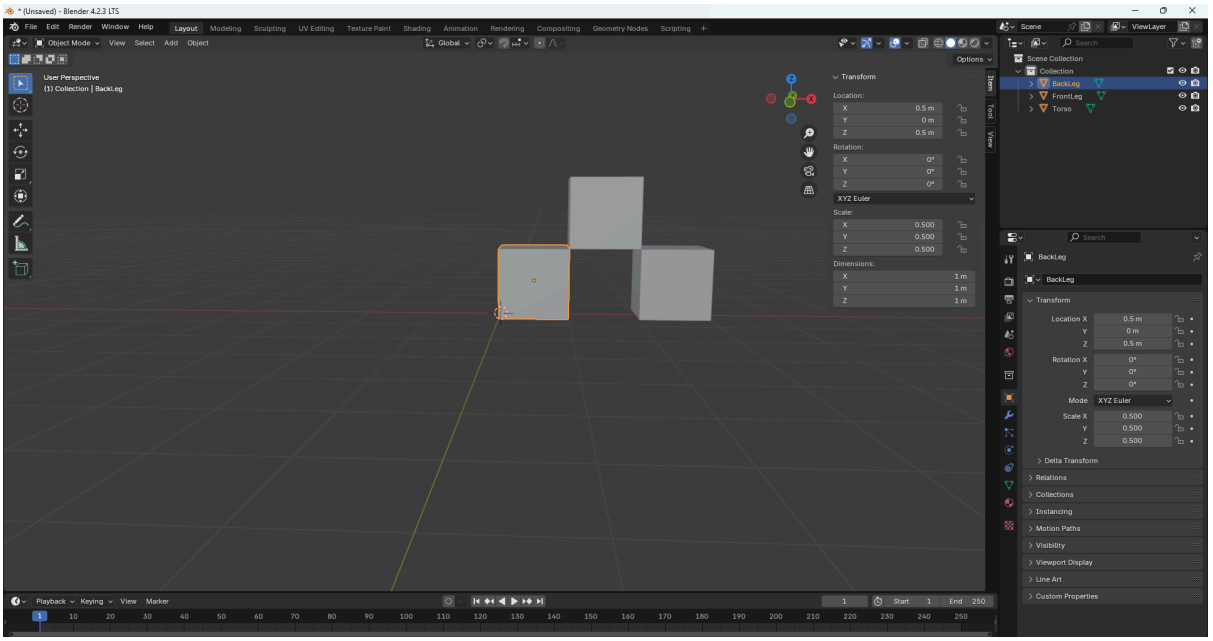
4. Now that our link is the right size, we can position it. In the diagram, the Torso link is at (1.5,0,1.5), so we'll adjust our location coordinates to those.



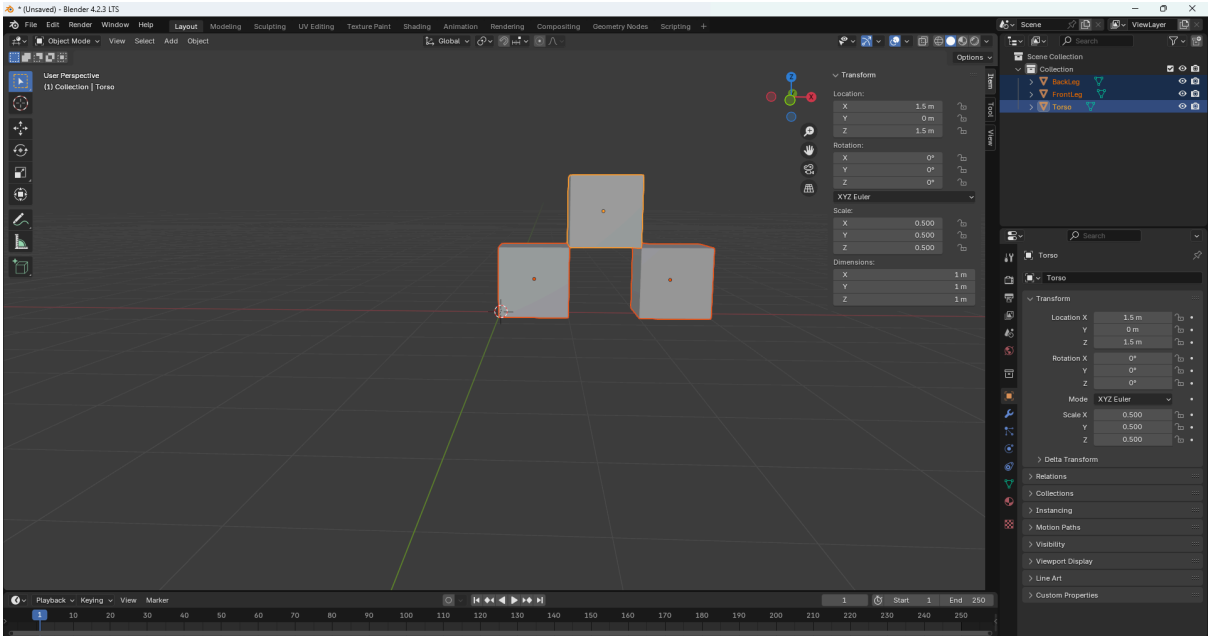
5. Let's add our other links. To add a new mesh, go to Layout-> Add -> Mesh -> Cube, which will add another (2,2,2) cube mesh at (0,0,0). Adjust the size of this mesh to match the Torso link we created earlier, rename this link to FrontLeg, and match its absolute location coordinates to the position on the diagram.



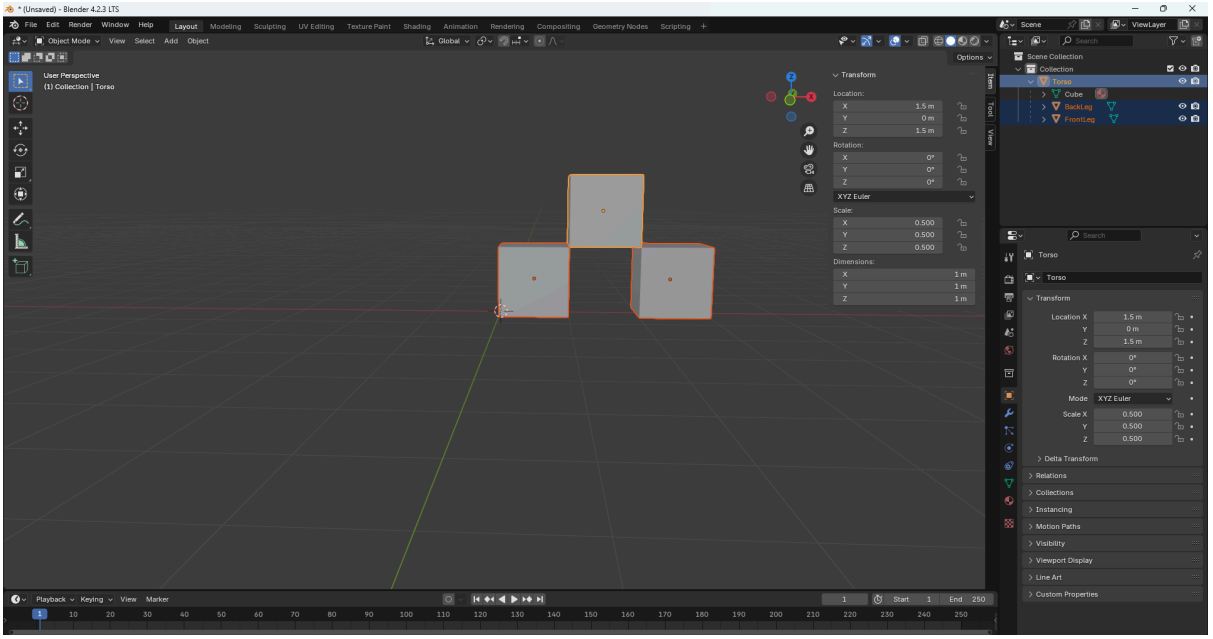
6. Repeat Step 5. to create our BackLeg link.



7. Once we have our links, it's time to add our relationship. Shift-click all of your links in the scene, clicking on Torso last. (You can do this is Scene Collection, but I find it easier to press on the links themselves in case I forget the name.) If you selected the links correctly, Torso should be highlighted in light orange and FrontLeg and BackLeg should be a darker orange, like below.

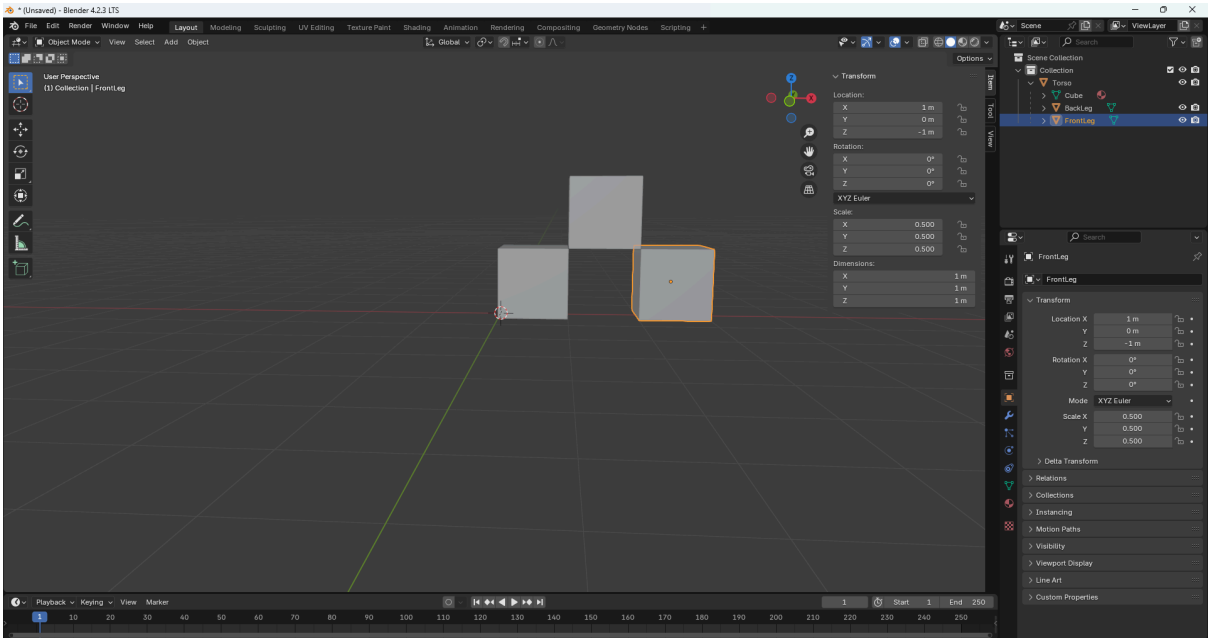


8. To set a parent relationship, press **Ctrl + p.** We set the parent to **Object (Keep Transform Without Inverse)** otherwise we will lose our current position, and may be unable to generate relative coordinates. If you set the parent relationship, Torso should become a header, with FrontLeg and BackLeg listed under it.



If you mess up and press the wrong relationship, you can clear the parent relationship either by selecting all links and right-clicking -> Clear Parent or by pressing Alt + p. You can also set the relationship via right click, but it gets complicated to sort through when you have a lot of links.

9. Now we get to check our relative coordinates in our transformation editor. Since Torso is at (1.5,0,1.5) our Child link FrontLeg's position changed from absolute (2.5,0,0.5) to relative (1,0,-1). Selecting BackLeg will show its relative coordinates as well.


* (Unsaved) - Blender 4.2.3 LTS
File Edit Render Window Help
Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Geometry Nodes Scripting
Object Mode View Select Add Object
Global
Options
User Perspective
(1) Collection | FrontLeg
Transform
Location:
X 1 m
Y 0 m
Z -1 m
Rotation:
X 0°
Y 0°
Z 0°
XYZ Euler
Scale:
X 0.500
Y 0.500
Z 0.500
Dimensions:
X 1 m
Y 1 m
Z 1 m
Item
Tool
View
Scene
ViewLayer
Search
Scene Collection
Collection
Torso
Cube
BackLeg
FrontLeg
FrontLeg
FrontLeg
Transform
Location X 1 m
Y 0 m
Z -1 m
Rotation X 0°
Y 0°
Z 0°
Mode XYZ Euler
Scale X 0.500
Y 0.500
Z 0.500
Delta Transform
Relations
Collections
Instancing
Motion Paths
Visibility
Viewport Display
Line Art
Custom Properties
Playback Keying View Marker
1
Start 1
End 250
1 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250