

Character assignment 3 - gray model

UW CSE490 summer 2023

Instructor: Dave Hunt

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Introduction

In this assignment we will start from the block model made in the previous assignment and combine it into a single, manifold gray model. We will then add more subdivisions to provide more detail to our character's form and silhouette.

Resources

<https://topologyguides.com/>

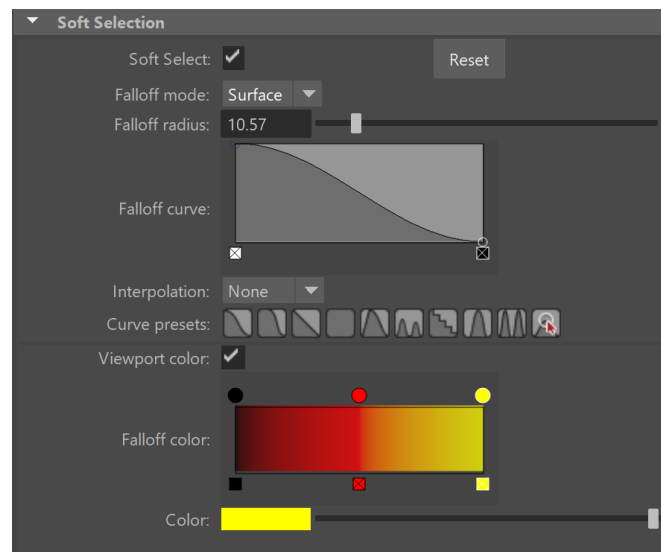
Hotkeys

- Hold down the “j” key while rotating to snap to precise angles (15, 30, 45, etc.)
- Use [Edit](#) → [Delete All by Type](#) → [History](#) to clear out the construction history from everything in your scene. The hotkey **alt + shift + d** is a shortcut for deleting history on the selected object(s).

Selection tips

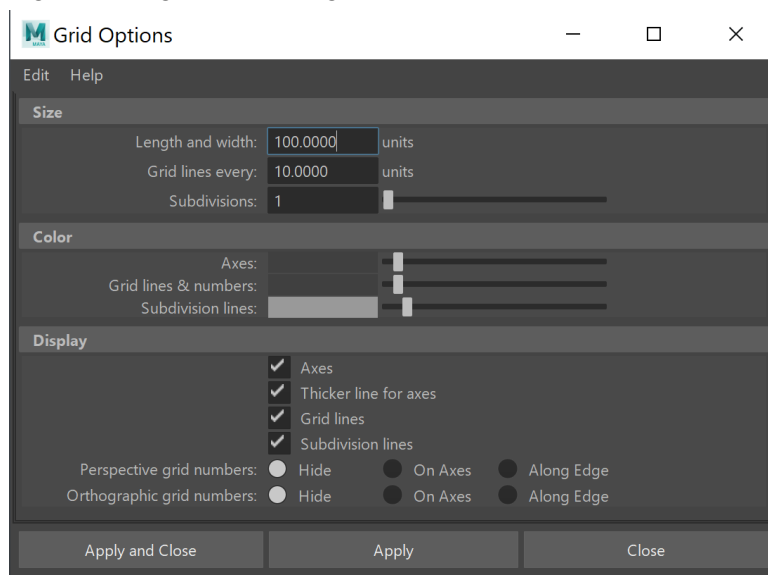
- Double click on an edge (while in edge selection mode) to select an entire edge loop
- [Grow selection](#) (in component mode) with the hotkey **shift + >**
- [Shrink selection](#) **shift + <**
- Press “b” to activate [soft select](#) mode. Press **b** again to turn it off.
 - Hold down **b** and drag with the left mouse button to change brush size

- In the **Move tool** options under Soft Selection change “Falloff mode” to *surface*



Grid Settings

Here are grid settings for working at this scale.



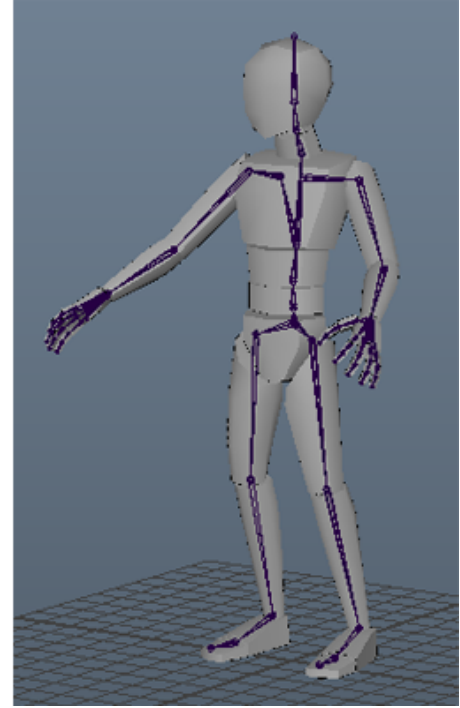
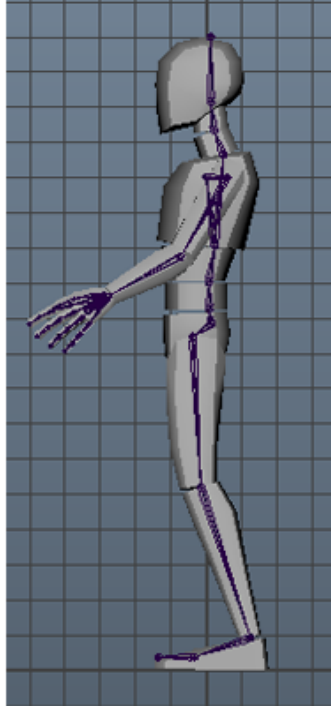
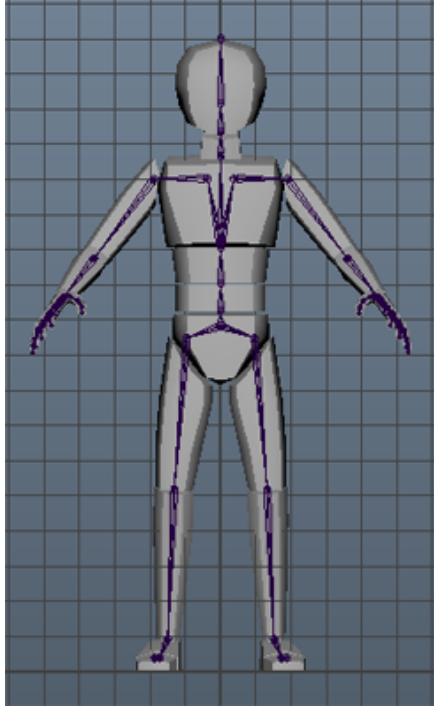
Part 1, Refining skeleton proportions

In the previous assignment we tested our character proportions by creating poses. If you see ways to improve your character’s proportions, take some time to make changes to the skeleton now before moving on to creating the gray model.

1. Open your finished block model with poses from the previous assignment and save it as a new scene called *assignment_3_gray_model.ma*.
2. Check your character proportions and see if there is anything you want to change.
Things to look out for:
 - In the **idle pose** are the tips of the fingers down to about the center of the thigh? This is how human proportions commonly work and it will help make sure that your character can comfortably hold an object with both hands.
 - In the **walk pose** can the character feel balanced and natural looking?
 - In the **crouch pose** are the heels roughly in line with the hips? Does the character look balanced with the knees pointing forward?
3. Set the Time Slider to frame 1 with the bind pose and delete the keyframes using [Edit → Delete All by Type → Channels](#).
4. Fix any proportional issues by moving bones on the skeleton and updating the block model shapes.

Part 2, Defining the bind pose

Before building our gray model we need to define a good **bind pose** for our skeleton so that the model will be in a good position for rigging and animation. How the bind pose should look depends on the character you are building and how they will move. Generally the skeleton should be posed with limbs in the middle of their range of motion. Arms should be aiming slightly down and forward at about 45 degrees with elbows and knees slightly bent. Feet should be flat on the ground. This will help make it easier to sculpt the character geometry and set up skin weights and control rigs on the skeleton.



1. Pose the skeleton into the bind pose

- a. Rotate the arms and legs into a slightly bent, relaxed position.
- b. Check from the side view camera to make sure your character looks balanced. If necessary, rotate the leg joints so they look like they are holding up the weight of the rest of the body.
- c. Make sure the feet are flat on the ground. If the feet are not on the ground, move the root joint so the character's feet align with the ground plane.

2. Double-check to make sure the skeleton is oriented correctly for animation as described in step 1.5 of assignment 2

- a. Pelvis - orthogonal to world space
- b. Chest - orthogonal to world space
- c. Head - orthogonal to world space
- d. Elbows - rotationally coplanar with shoulder and wrist
- e. Knees - rotationally coplanar with hip and ankle
- f. Hands - inline with lower arm
- g. Feet - inline with knees

3. Finalize the skeleton

- a. Mirror the skeleton
 - i. Delete left side joints
 - ii. Select the right clavicle joint
 - iii. [Skeleton → Mirror Joints](#) [options] YZ, Behavior
 - iv. Repeat with the right hip joint selected
- b. Freeze transformations
 - i. Select center_root_bind_joint

ii. [Modify → Freeze Transformations](#)

Remember to save your scene!

Part 3, Combining the block model into a gray model

The next step is to combine all of the block models into a single manifold piece of geometry. The block models were subdivided evenly with matching subdivisions so they can connect seamlessly with vertices merged together. It is important to keep the gray model with clean topology having evenly spaced quads and if possible no triangles or n-gons. Having evenly laid out geometry will make it easy to subdivide later and set up skin weights.

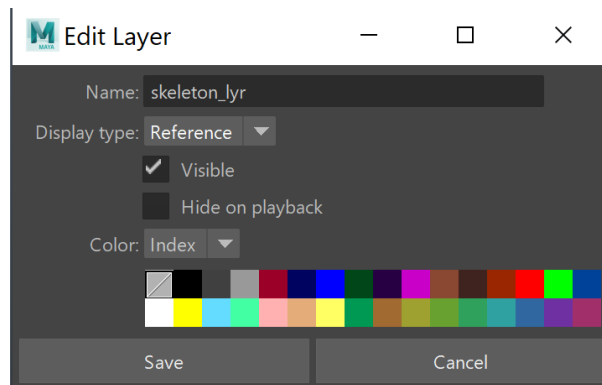
We can start by working on the right side of our character model and then mirror to the left side.

3.1, Setting up your model and viewport

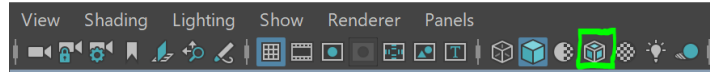
1. **Unparent** all of the block model pieces from the skeleton
 - a. Select the models and press **shift-p** to unparent
 - i. It helps to toggle off the **joint selection mask** first



- b. With the models still selected press **ctrl-g** to group them
2. Add the skeleton to a new **display layer**
 - a. Select *center_root_bind_joint*
 - b. In the Display layers panel click [Layers → Create Layer from Selected](#)
 - c. Double-click the new layer to open the settings panel
 - i. Name it *skeleton_lyr*
 - ii. Set it to **Display type: Reference**



3. Set the viewport to display **Wireframe on shaded**. This will make it easier to line up vertices when combining the models.
 - a. On the panel menu click this icon



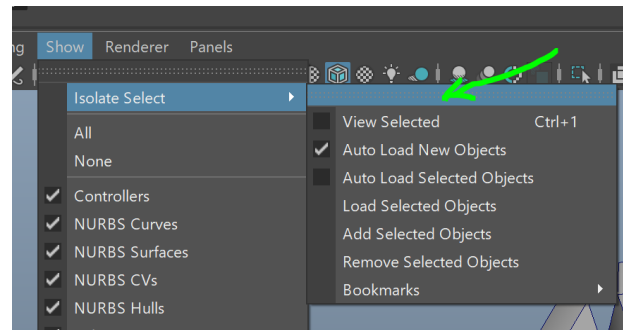
4. Turn on the **poly count** heads up display
 - a. On the main menu: **Display → Heads Up Display → Poly Count**

	781	41	8
Verts:	781	41	8
Edges:	1356	76	0
Faces:	672	36	0
Tris:	1344	72	0
UVs:	1215	55	0

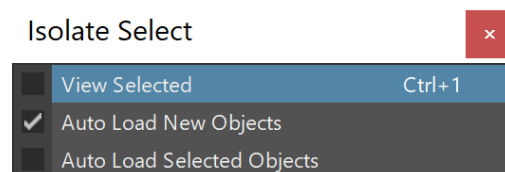
- b. This is helpful when merging vertices so you can see how many are selected

3.2, Combine the arm segments

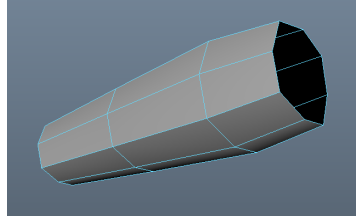
1. **Delete interior faces** for each segment
 - a. Select the lower arm block model
 - b. Isolate the selected object
 - i. On the panel menu click **Show → View Selected**



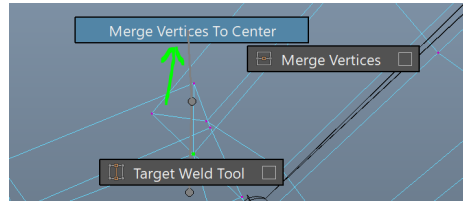
- ii. It might help to tear off this menu so you can easily access and toggle the **View Selected** command. You can tear off any menu in Maya by clicking the dashed line at the top of each menu as shown above.



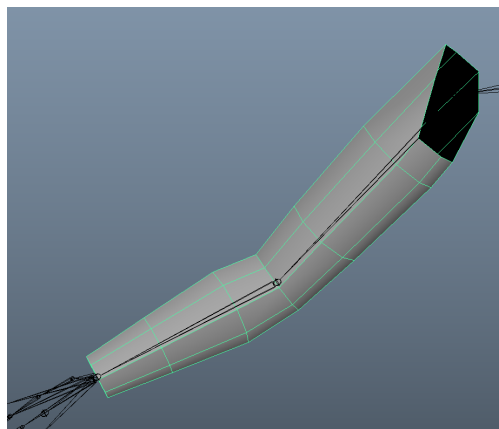
- c. Delete faces on both ends of the block where it will connect to the other blocks
 - i. **Right-click** (and hold) the model and click **Face**
 - ii. Select the 4 faces on the end and press **delete**
 - iii. Also delete the 4 faces on the other end



- d. Toggle **View Selected** back on.
2. Repeat the above step for the upper arm block model
3. **Combine** the upper and lower arm segments
 - a. Select upper and lower arm blocks
 - i. On the **Modeling** menu-set: **Mesh → Combine**
(Combine is also on the polygon context menu: **shift-right-click**)
4. **Merge vertices** at the elbow
 - a. Select two vertices that you want to combine
 - b. **Shift-right-click** (and hold) to bring up the polygon context menu
 - c. **Merge Vertices → Merge Vertices to Center**



- d. You can also use the **Target Weld Tool** by dragging one vertex onto the other
- e. It is also possible to merge multiple vertices based on a position threshold in the **Merge Vertices** options window.
5. **Delete History** on the arm model
 - a. Select the arm model
 - b. **Edit → Delete by Type → History**

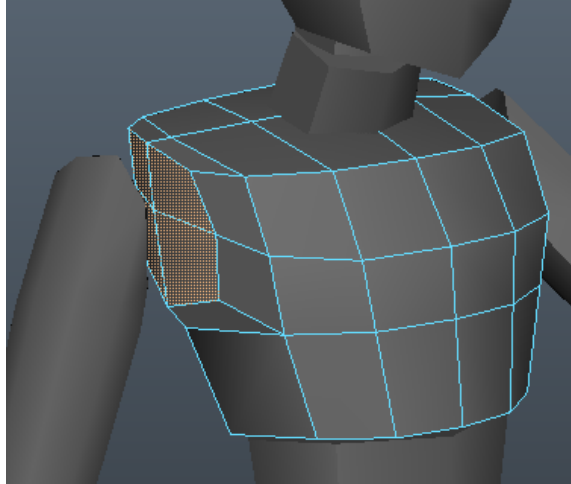


6. Repeat the steps above to combine the arm and hand segments

3.3, Combine the arm and chest segments

1. Add a vertical edge loop to the bottom half of the chest

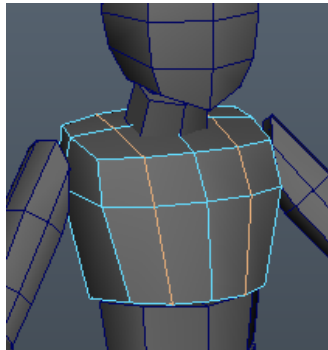
2. **Extrude** the four faces on the side where the shoulder will connect.
 - a. Select the four faces and **shift-right-click Extrude**
 - b. Scale and move the faces to match the profile of the shoulder
 - c. **Delete** the faces



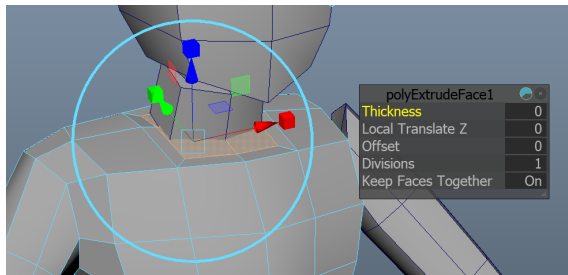
3. Combine the arm and chest models
4. Merge the vertices in the shoulder area

3.4, Combine the chest and neck segments

1. Insert two vertical edge loops on the chest



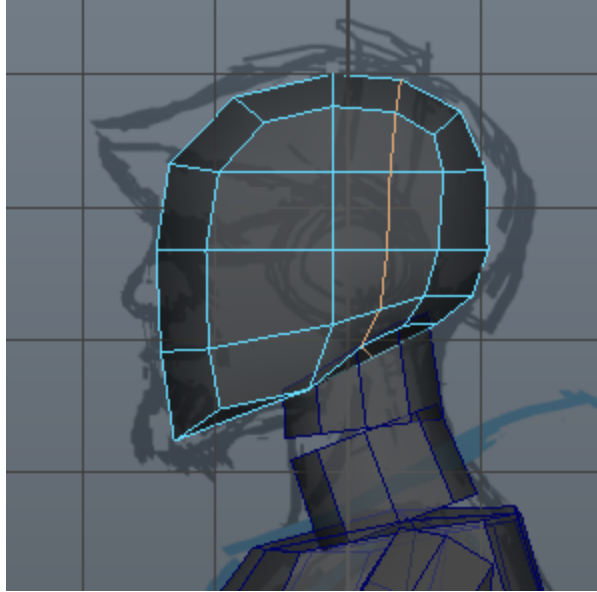
2. **Extrude** the 4 faces on the chest where it will connect to the neck
 - a. Select the four faces and **shift-right-click Extrude**
 - b. **Scale** and **move** the faces to match the profile of the neck
 - c. **Delete** the faces



3. **Delete** the end faces of the neck block
4. **Combine** the chest and neck models
5. **Merge vertices** where the neck connects to the chest
6. Also **combine** the other neck and abdomen segments

3.5, Combine the neck and head

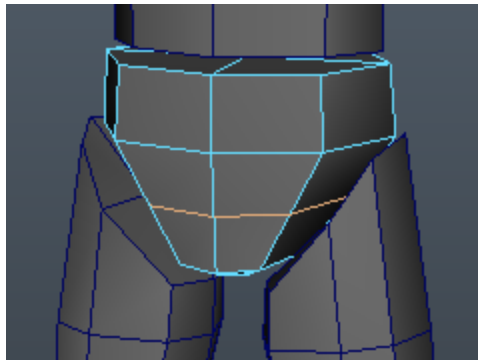
1. **Insert edge loops** to the head to match the profile of the drawings in front and side view (try not to add too much detail yet, only about 2x more geometry)



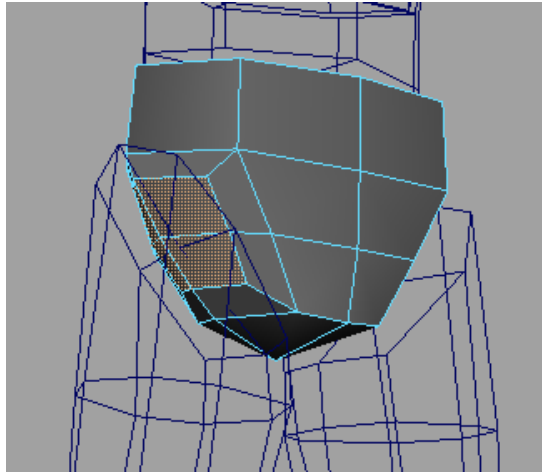
2. Make sure there are 4 faces at the base of the head where it will connect to the neck
3. **Extrude** the 4 faces at the base of the head, **scale** and **delete** them similar to how the neck connects to the chest in step 3.4 above
4. **Combine** the head and body models
5. **Merge vertices** where the head connects to the neck

3.6, Combine the pelvis and legs

1. **Insert an edge loop** horizontally to match the number of vertices on the end of the leg



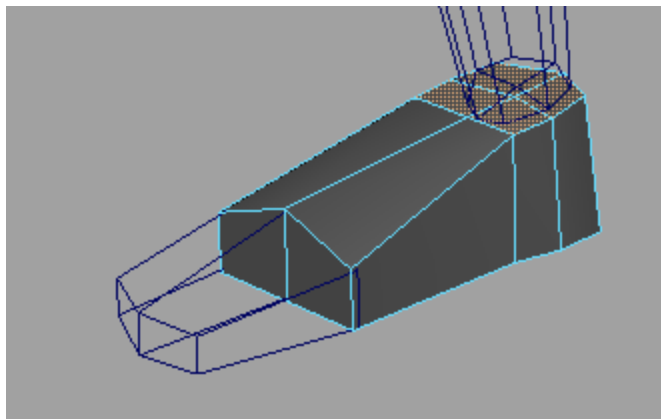
2. **Extrude** the 4 side faces and **scale** them down



3. **Delete** the extruded faces
4. **Delete** the end faces on the leg model
5. **Combine** the leg and pelvis models
6. **Merge vertices** in the hip area where the pelvis connects to the leg
7. Also combine the lower

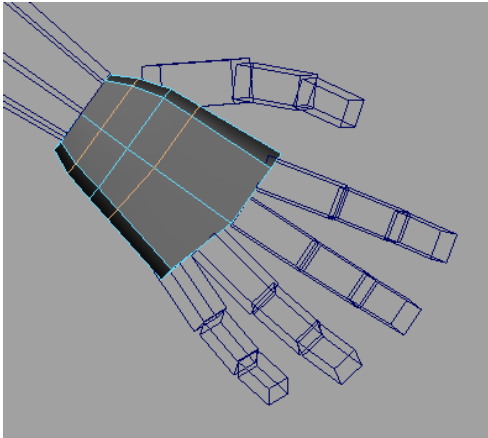
3.7, Combine the leg and the foot

1. Insert an edge loop at the heel so the leg can connect to the foot with the same number of vertices

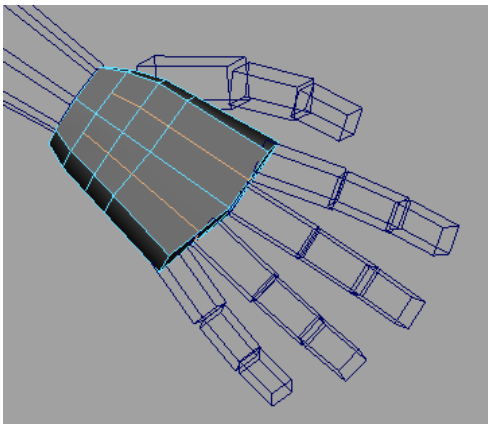


2. **Extrude** these 4 faces, **scale** them down and then **delete** them
3. **Combine** with the leg and merge vertices

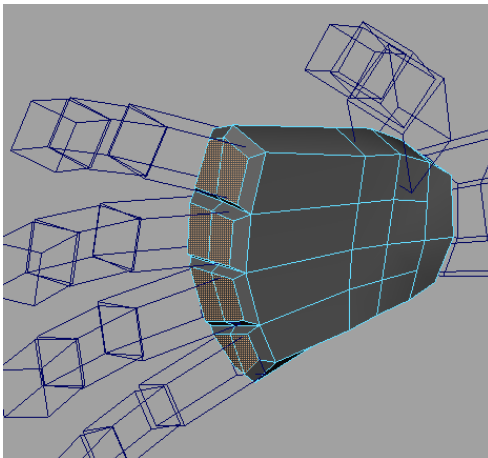
3.8, Combine the hand and fingers



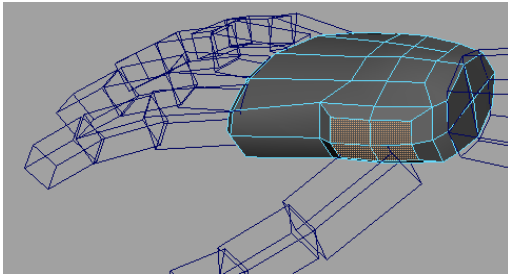
1. **Insert edge loops** to the hand as shown in the image



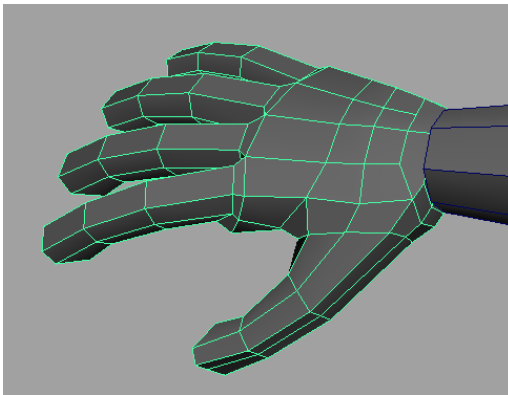
2. Split the edges as shown in the screenshot below. Hold down **shift-right-click** to open the polygon context menu and click [Multi-Cut Tool](#)



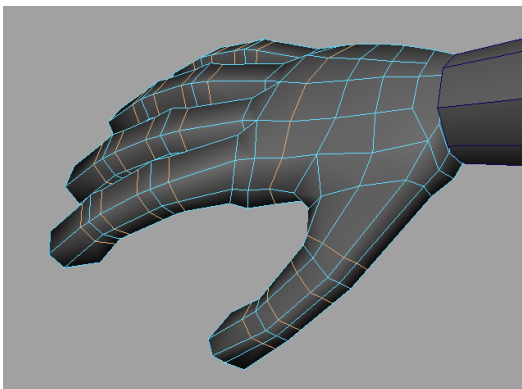
3. **Extrude** each of the faces where the fingers will attach



4. **Extrude** the faces where the thumb will attach



5. **Insert edge loops** horizontally across the fingers and combine them with the hand

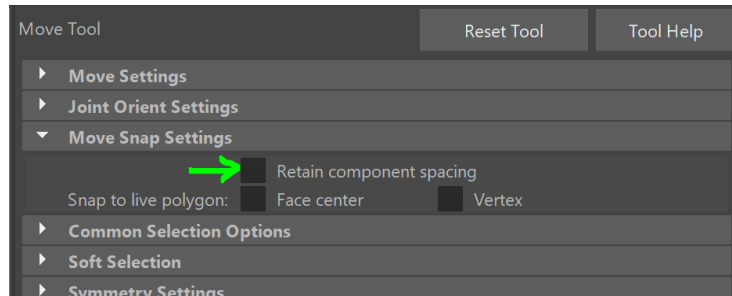


6. **Insert edge loops** to the hands and fingers as shown in the image

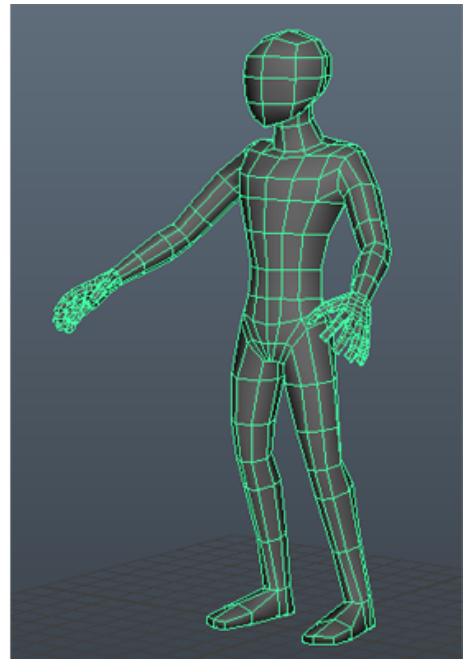
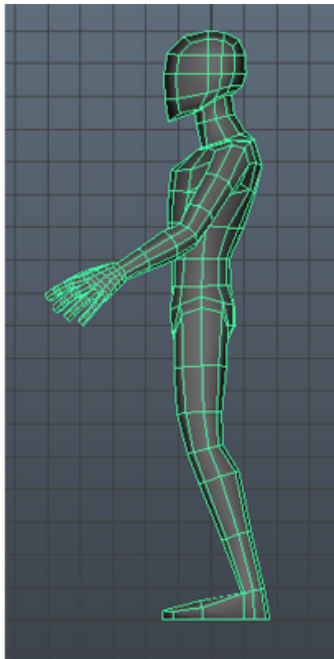
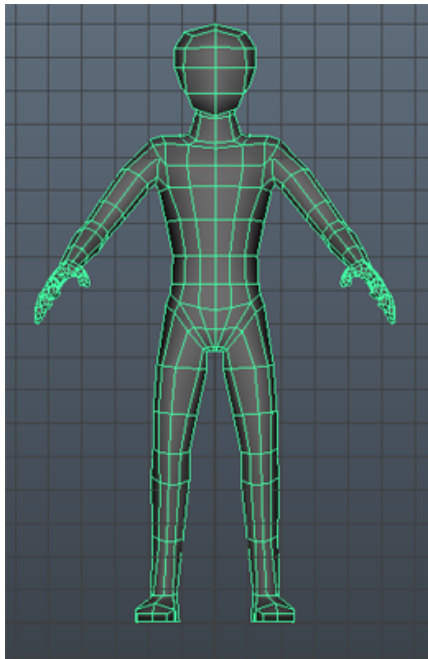
3.9, Mirror the gray model geometry

Once all of the pieces are connected on the right side you can mirror this to the left side

1. Delete any unused block models on the left side
2. On the middle sections (back, neck, head) delete the faces on the left side
3. Make sure the vertices down the middle are centered on the X axis. From the front view camera select the line of vertices down the middle. With the move tool hold down **x** for grid snapping and translate the X axis to the center.
 - a. Note: if the vertices are not snapping exactly to the X axis you may need to uncheck **Retain component spacing** in the **Move tool** options. (open the Move tool options by double-clicking the move tool icon)



4. Mirror the geometry from right to left
 - a. Select the model, **shift-right-click** to open the polygon context menu and click [Mirror Polygon](#) → [Mirror +X](#)
5. Soften edges
 - a. **Shift-right-click** the model and click [Soften/Harden Edge](#) → [Soften Edge](#)
6. Delete construction history on your gray model
 - a. Select the model and click [Delete by Type](#) → [History](#)



Remember to save your scene!

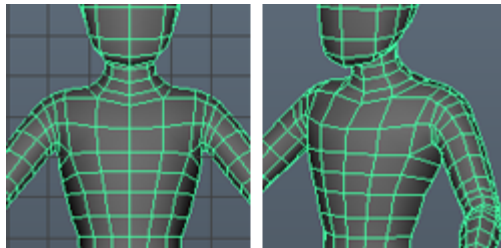
Take screenshots of your **initial gray model** at this stage and add them to your Miro board to turn in with your assignment.

Part 4, Adding subdivisions and sculpting

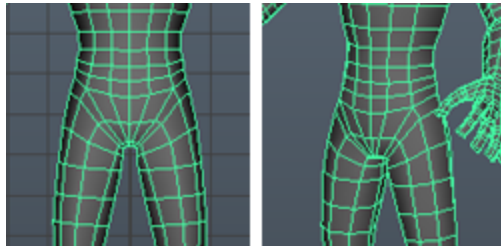
Next we will add additional subdivisions so that we can sculpt our gray model to match the front and side drawings more closely. We will also be adding more geometry around the flexible areas such as elbows and knees where our model will bend and deform when it is animated. It is necessary to have enough edge loops in flexible areas so that it can maintain volume.

4.1 Shoulders and hips

1. **Insert edge loops** to the shoulders area
 - a. Sculpt the vertices to match your front and side orthographic drawings
 - b. Try to keep it at about this resolution and topology layout

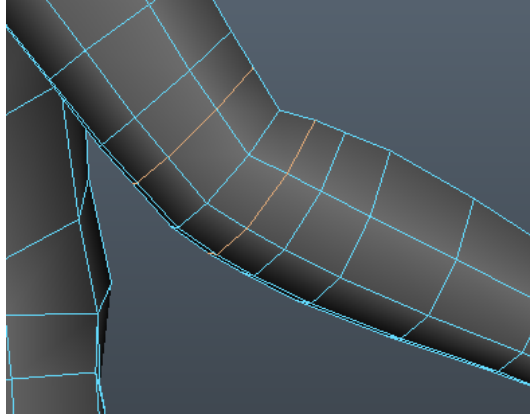


- c. (don't add too much detail or extra subdivisions at this stage because we will add more in the costume assignment. It is easier to do skin weights with less geometry)
2. **Insert edge loops** to the hips area
 - a. Sculpt the vertices to match your front and side orthographic drawings
 - b. Try to keep it about this resolution and topology layout

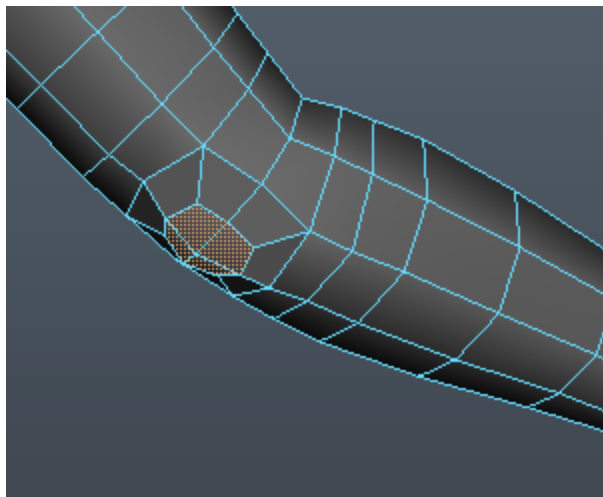


4.2 Elbows and knees

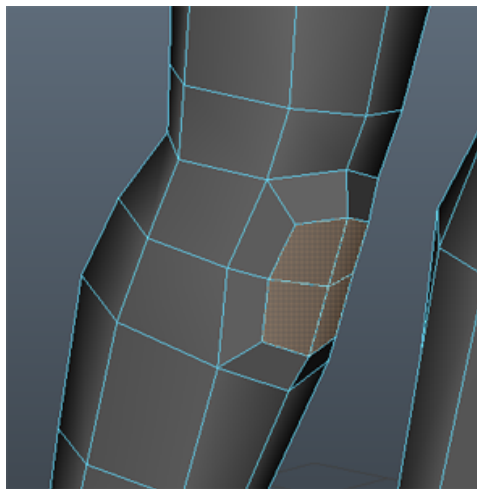
1. **Insert edge loops** so that there are more vertices around the flexible area of the elbow



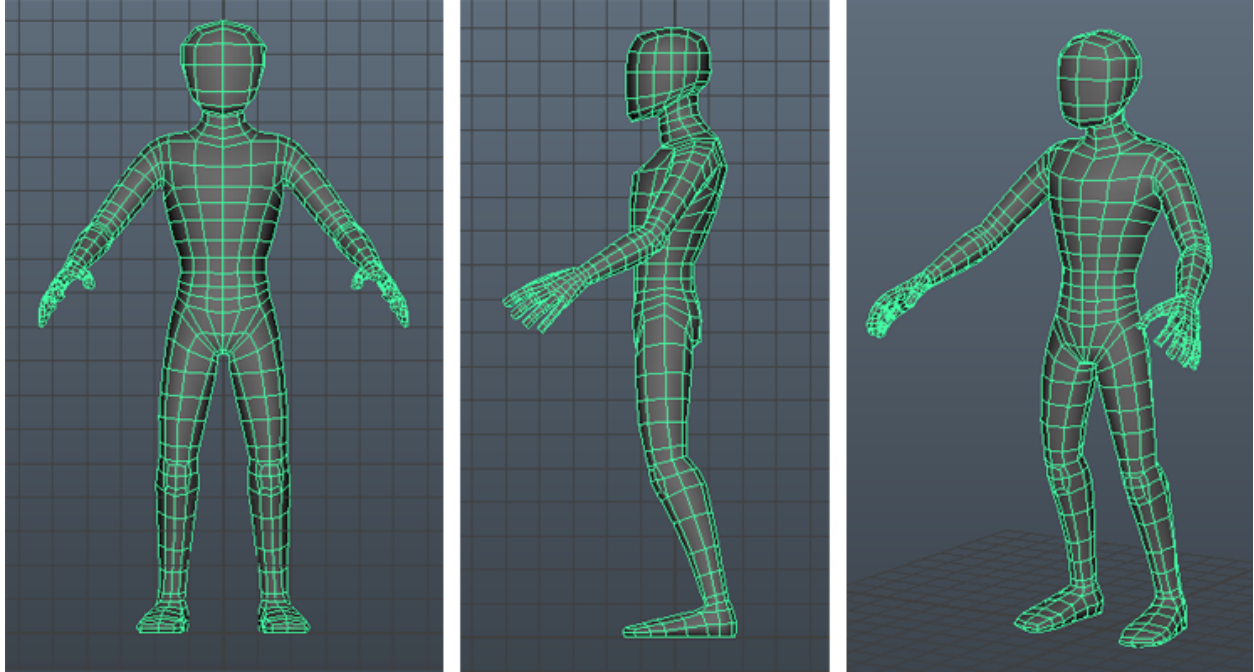
2. **Extrude** the 4 faces at the back of the elbow
 - a. **Scale** and **move** the faces and sculpt the vertices to add more definition



- b. (the extra topology here will help the elbow hold its shape when it deforms)
3. Repeat these steps for the knees



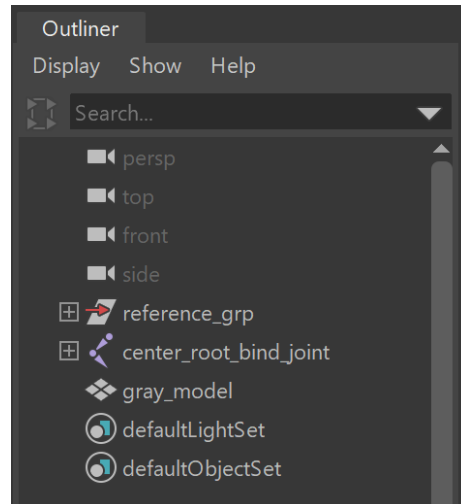
Continue inserting edge loops and sculpting until your gray model looks about like this:



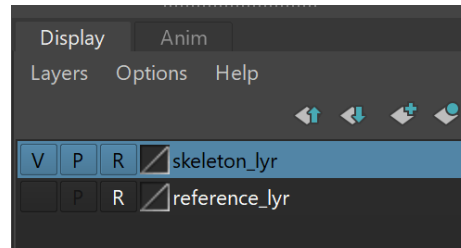
4.3, Finalizing the gray model

When you are finished sculpting your gray model take the following steps to finalize it.

1. Align the model with the skeleton
 - a. Check in front, side and perspective camera views to make sure that your model aligns with the skeleton. It is common for the model to drift away from the skeleton while sculpting. If this has happened, use the modeling tools to bring it back into position (the soft-selection tools can be useful here - see above.)
2. **Mirror geometry**
 - a. Delete the left side faces
 - b. Align the center vertices to the X axis with the **Move** tool holding **x** to grid snap
 - c. Select the model, **shift-right-click** and [Mirror Polygon → Mirror +X](#)
3. **Soften edges**
 - a. Select the model, **shift-right-click** and [Soften/Harden Edge → Soften Edge](#)
4. **Freeze transformations**
 - a. Select the model, [Modify → Freeze Transformations](#)
5. **Delete history**
 - a. Select the model, [Edit → Delete by Type → History](#)
6. Name it *gray_model*
7. Delete any extra unused nodes in the **Outliner**. The only things we need in the Outliner are the model, skeleton and reference_grp as shown in the image below.



8. Delete any unused **display layers**. The only layers we need are reference_lyr and skeleton_lyr. Make sure your skeleton and references are assigned to the correct layers



End of part 4.

Save your scene as *assignment_3_gray_model.ma* and turn it in with your assignment.

Take screenshots of your **final gray model** and add them to your Miro board to turn in with your assignment.

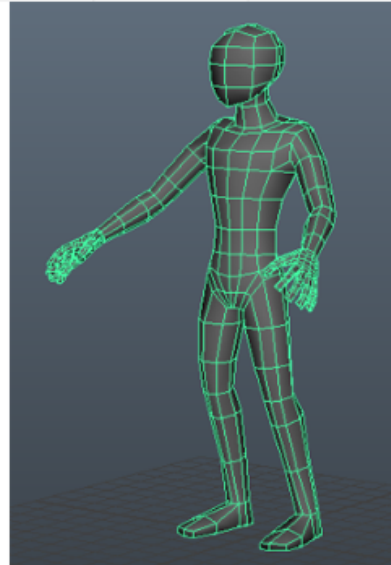
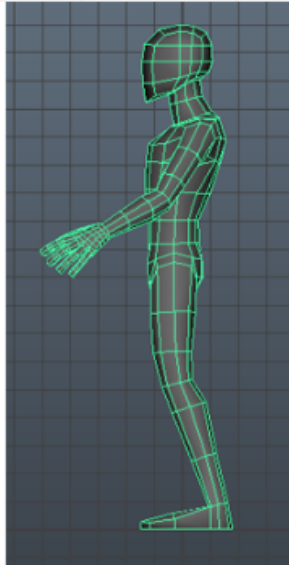
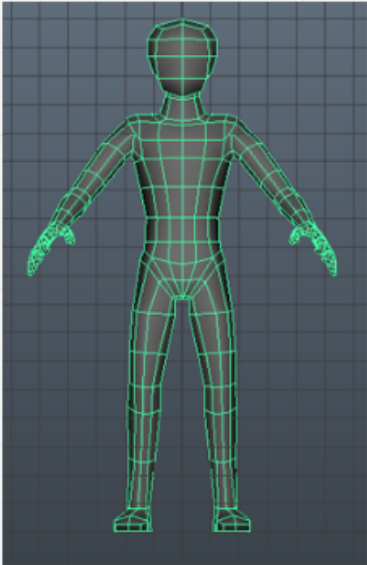
You may optionally export your gray model as FBX to Unity to use as scale reference for your world building assignments.

Grading rubric

Criteria	Achievement levels			
	level 1	level 2	level3	level4
Gray model file format: Maya (.ma)	20 points: (0 incorrect) Maya file is named <i>assignment_3_gray_model.ma</i> and file type is Maya ASCII	18 points: (1 incorrect) Maya file is named <i>assignment_3_gray_model.ma</i> and file type is Maya ASCII	16 points: (2+ incorrect) Maya file is named <i>assignment_3_gray_model.ma</i> and file type is Maya ASCII	0 points: files were missing
Gray model scene (same file as above)	20 points: (0 incorrect) Outliner is clean and has no extra nodes. Display layers include skeleton_lyr and reference_lyr	18 points: (1 - 2 incorrect) Outliner is clean and has no extra nodes. Display layers include skeleton_lyr and reference_lyr	16 points: (3+ incorrect) Outliner is clean and has no extra nodes. Display layers include skeleton_lyr and reference_lyr	0 points: files were missing
Gray model (same file as above)	20 points: (0 incorrect) Model is named gray_model, it is aligned with the skeleton. It is in one continuous piece with no holes. History is deleted and transformations are frozen	18 points: (1-2 incorrect) Model is named gray_model, it is aligned with the skeleton. It is in one continuous piece with no holes. History is deleted and transformations are frozen	16 points: (3+ incorrect) Model is named gray_model, it is aligned with the skeleton. It is in one continuous piece with no holes. History is deleted and transformations are frozen	0 points: files were missing
Gray model topology (same file as above)	20 points: (0 incorrect) Model is all quads and mostly matches the screenshots in the assignment. 8 vertical sections on arms and legs. Knees and elbows are extruded	18 points: (1-2 incorrect) Model is all quads and mostly matches the screenshots in the assignment. 8 vertical sections on arms and legs. Knees and elbows are extruded	16 points: (3+ incorrect) Model is all quads and mostly matches the screenshots in the assignment. 8 vertical sections on arms and legs. Knees and elbows are extruded	0 points: files were missing
Miro Board format: images [Miro]	20 points: (0 incorrect) Miro board has screenshots for initial gray model and final gray model	18 points: (1 incorrect) Miro board has screenshots for initial gray model and final gray model	16 points: (2+ incorrect) Miro board has screenshots for initial gray model and final gray model	0 points: files were missing

Character class 3 - gray model

Initial gray model



Final gray model

