CI605 Advanced Modelling and Animation

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Digital Games Development

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Section 1: Introduction

1.1 Aims

When I first started this project, my idea was to create a concept revolved around the Lord of the Rings, but this concept changed around the start of the project. This is why you will see some different concept art at the start. My project evolved into the idea of creating a base defence game revolved around Star Wars and more specifically the battle of Hoth.

The idea will consist of a ATAT and soldiers storming towards the base where the player will be positioned in a turret, which will be shooting at the attackers to prevent them from damaging the base.

I am planning for the ATAT to have 2 animations, a death animation where it falls tremendously onto the ground using keyframe animation and a Walking Animation. The walking animation will be animated by not using keyframe animation or in Maya at all but will be animated using Procedural Animation in Unity, which allows the ATAT to walk by using code.

The soldier will have 3 animations a crouching animation, which plays once then transitions into a shooting animation, which plays on repeat until the soldier dies. A walking animation will be implemented by using the Advanced Skeleton Rig and the walk designer to customise the type of walk needed. The soldier will also be holding a gun, which will be constrained to the elbow joint this creates the illusion that the gun is being held by the soldier.

A simple turret will be constructed with a few joints this won't be animated but in unity I will use an aim constraint on the joints to dynamically move the turrets head at the ATAT.

Finally, I will create a few objects which will be scattered around the environment.

1.2 Style Choice

For the models I wanted to go for a Low Poly style but when it came to texturing low poly, normally it uses flat colours but I did want to do this as I like the stylised look but decided to use more detail textures to show of new skills in Substance painter.

1.3 Models and Animation Unity Showcase

Video - https://youtu.be/W64ZHiiG08A

Section 2: Modelling

2.1 Modelling Hobbit now Solider

2.1.1 Concept Art Inspiration (Hobbit)

Figures - 2.1, 2.2, 2.3, 2.4

2.1.2 Stylistic Inspiration (Low Poly Modelling)

Figures 2.5, 2.6, 2.7, 2.8, 2.9

2.1.3 Hobbit Concept Art

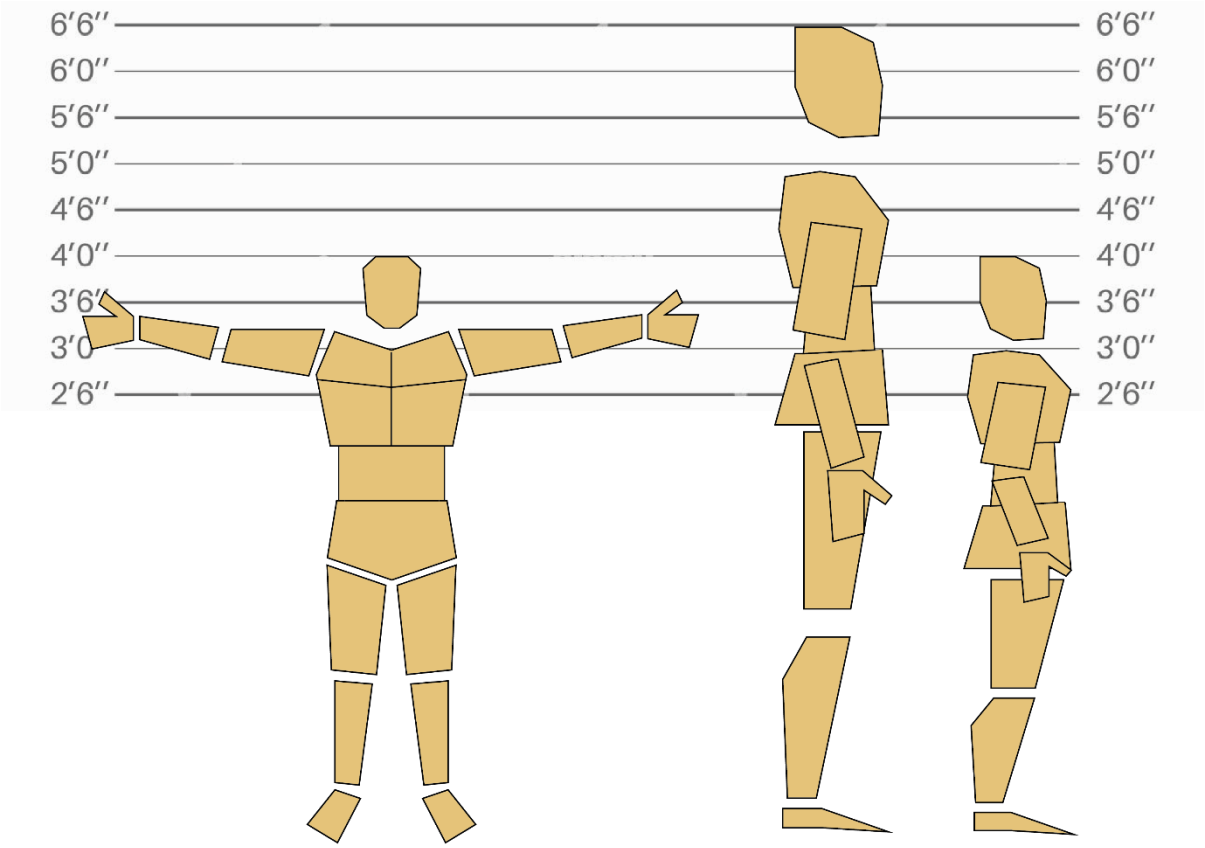

Figure 2.10 – Anatomy Concept Art Side/Front View

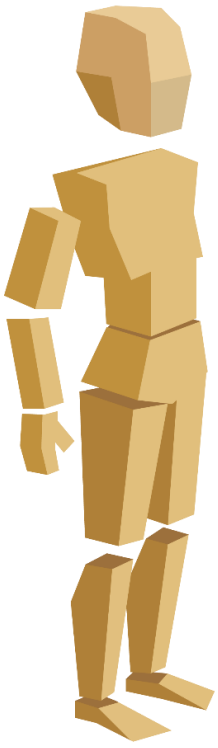

Figure 2.11 – Anatomy Concept Art ¾ view

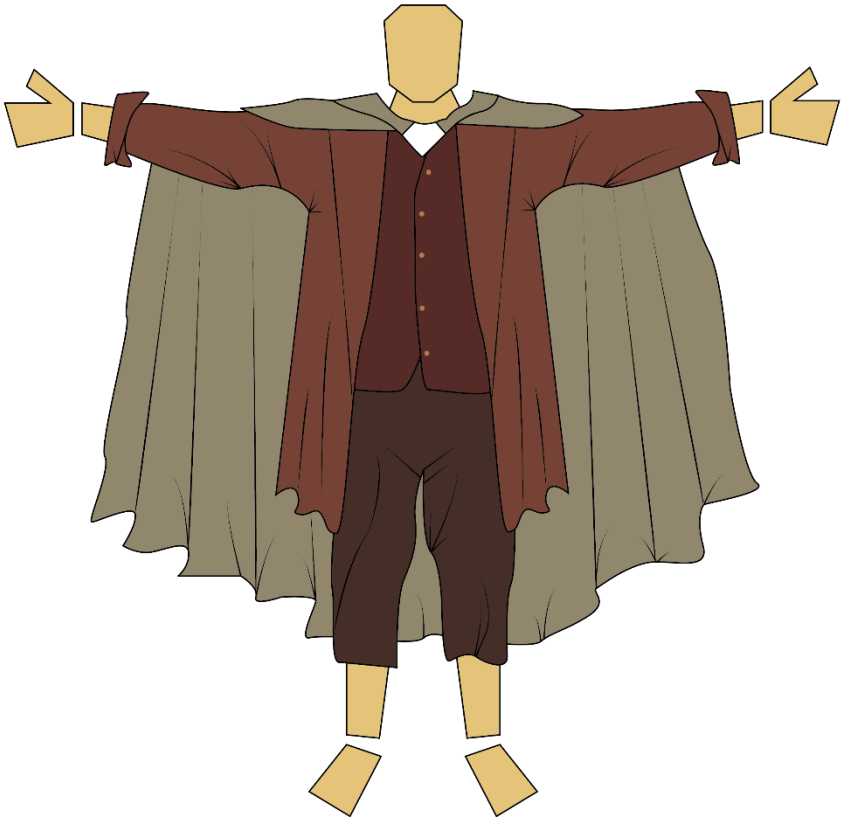

Figure 2.12 – Clothing Concept Art printed over Anatomy Concept Art

2.1.4 Hobbit now Solider

Starting with the Hobbits Head I morphed the vertices on the cube against the concept Art to create a good starting point with the overall form of the head. As low poly was my aim for this model I knew I could keep the form quite simple, however I still wanted to make a believable form and my concept art wasn't efficient enough for that. Instead I used figure 2.15 to show me the correct human form so I was able to create the jawline, eye sockets, nose, forehead and ears effectively with the least amount of details but still showing the correct anatomy. The use of edge loops and the multi-cut tool allows me to add edges which I can manipulate to give the correct form. This was process was done for all the other body parts trying to use the least number of faces as possible however when it was time to animate due to the lack of topology the limbs bent unrealistically cause me to add more faces and edges in.

Throughout the process of modelling the entire character, I was creating it symmetrically by taking my original cube and cutting it in half and using the Duplicate Special function but instead of creating using Geometry Type Copy in its settings, I created an instance instead. This allowed me to only model one side of the character as the other side changed with it in real-time which prevented me from making an unsymmetrical model.

I wanted to create some clothes for the mesh as well which was quite simple as I just took the faces of the clothing part I wanted to create and duplicate the faces which I then scaled up over the mesh and manipulated the vertex to create clothes.

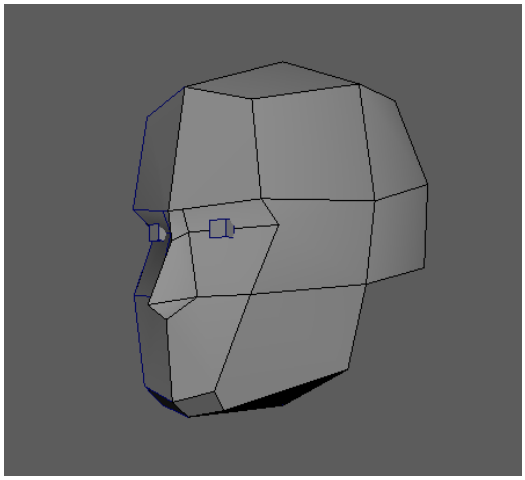

Figure 2.13 – Head Mesh

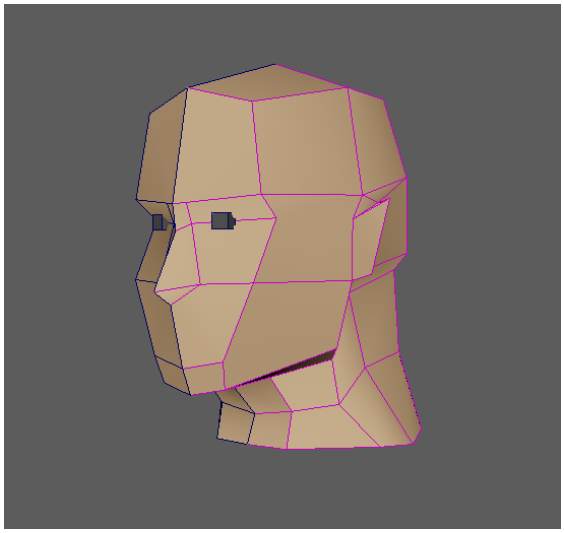

Figure 2.14 – Finished Head Mesh

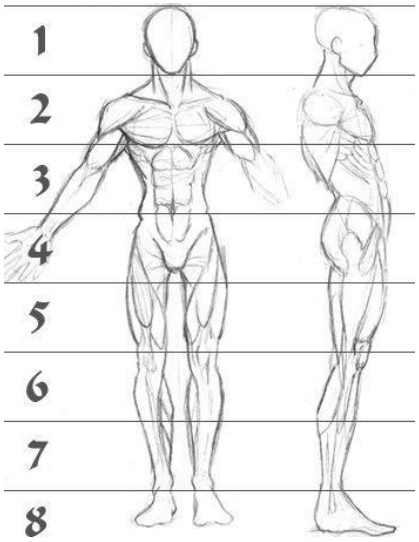

Figure 2.15 – Human Dimensions Diagram

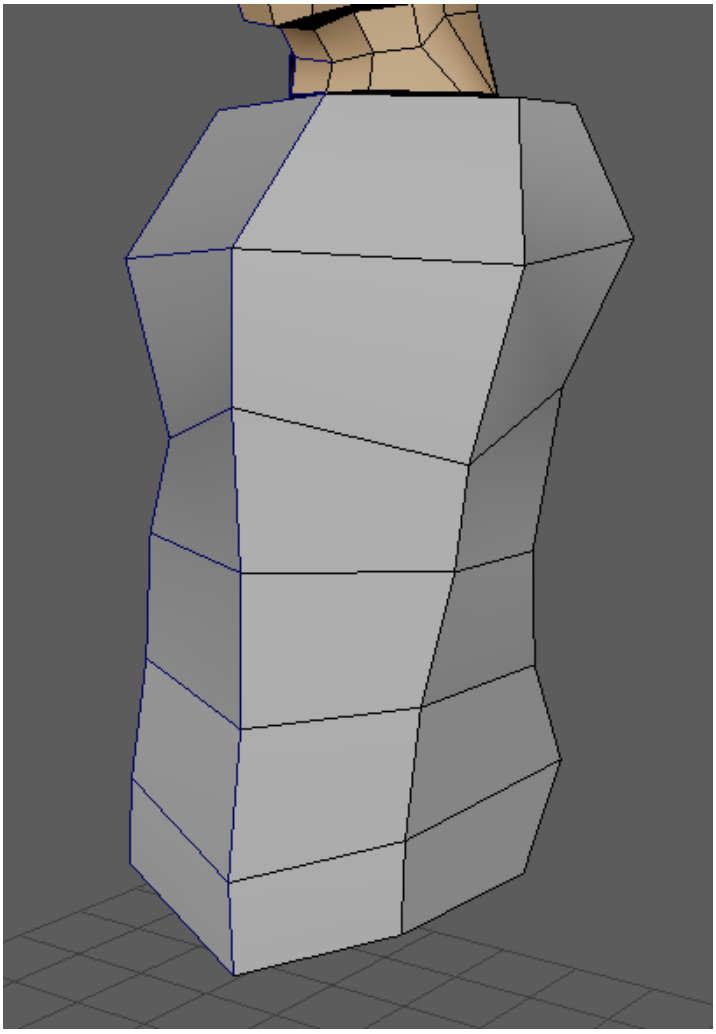

Figure 2.16 – Chest Mesh

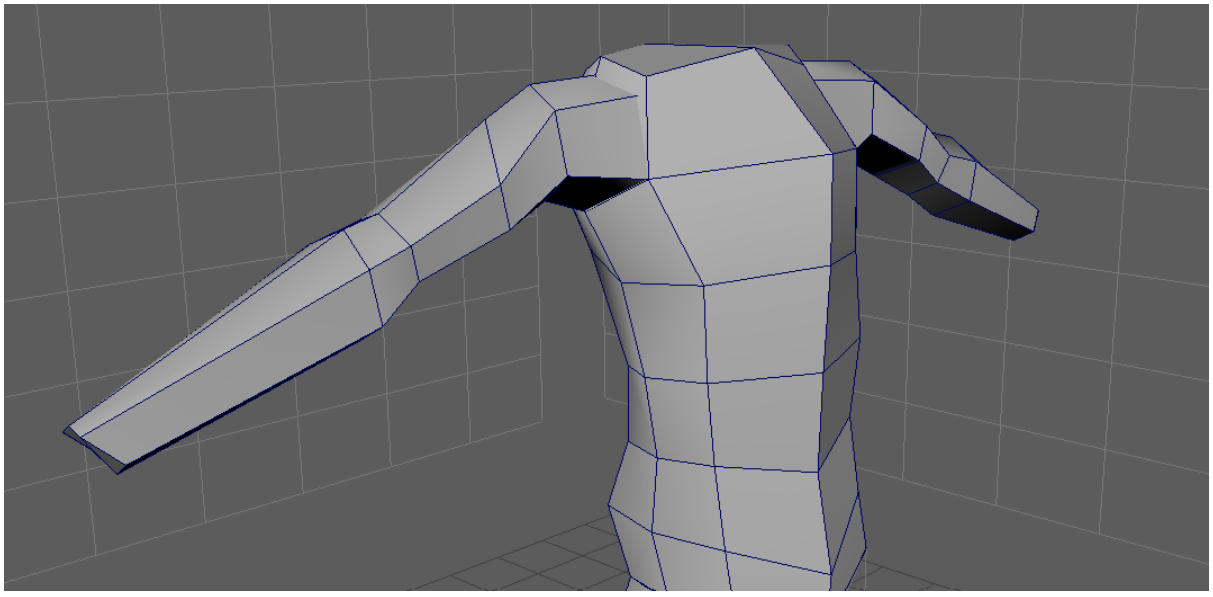

Figure 2.17 – Finished Chest and Arm Mesh

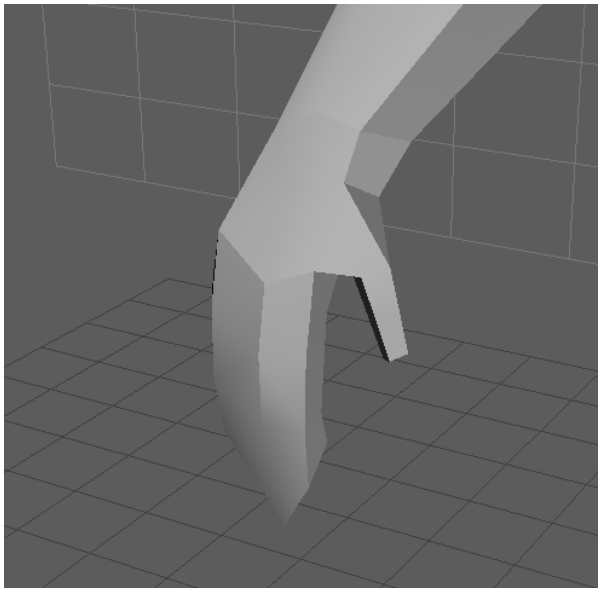

Figure 2.18 – Finished Hand Mesh

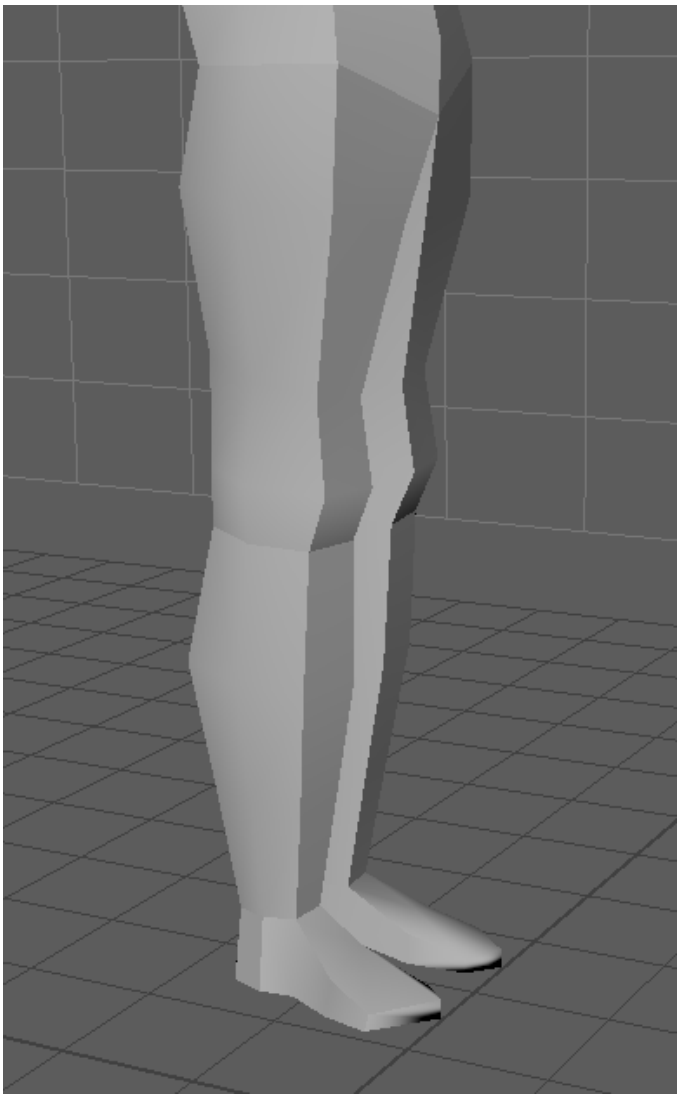

Figure 2.19 – Finished Leg and Foot Mesh

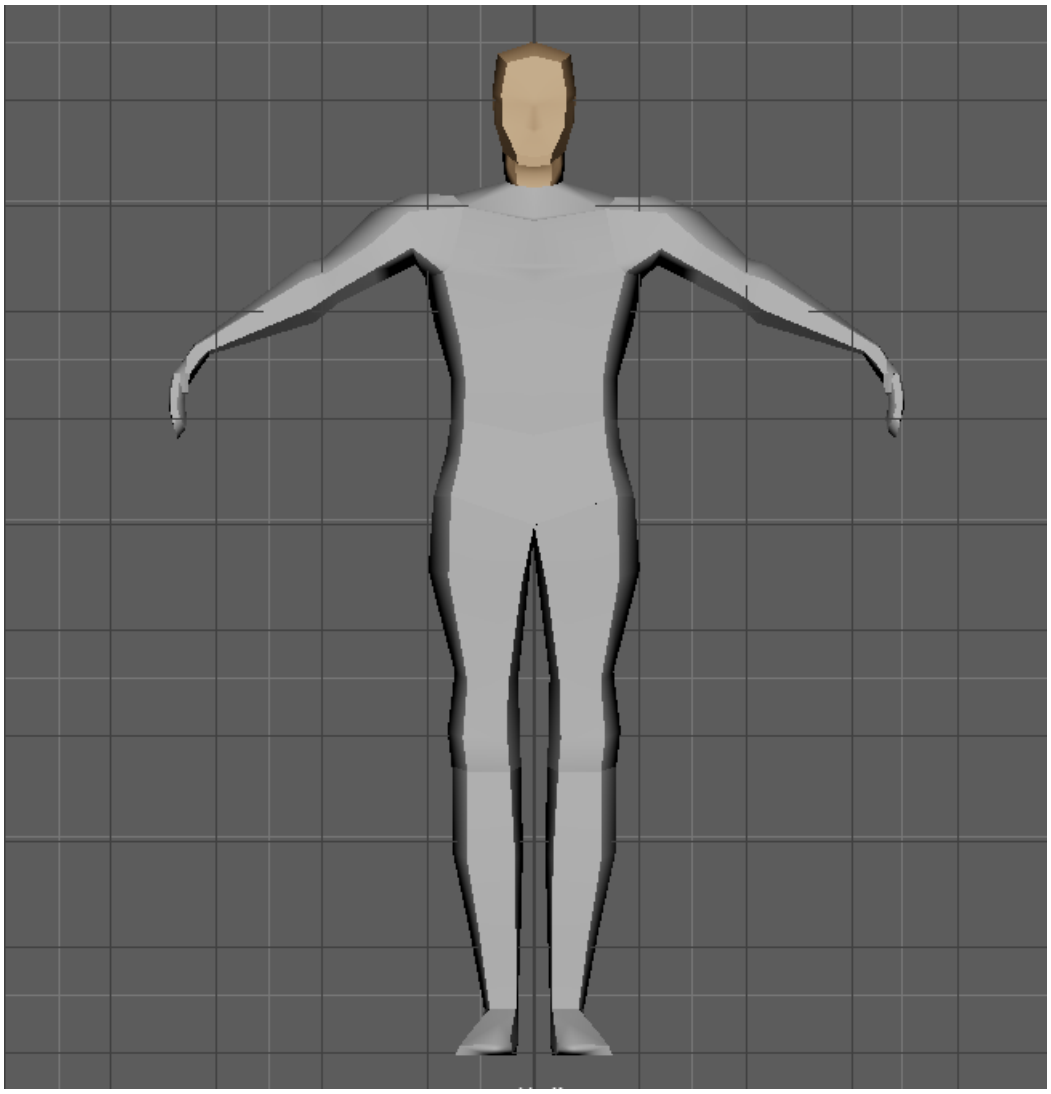

Figure 2.20 – Finished Complete Mesh Front View

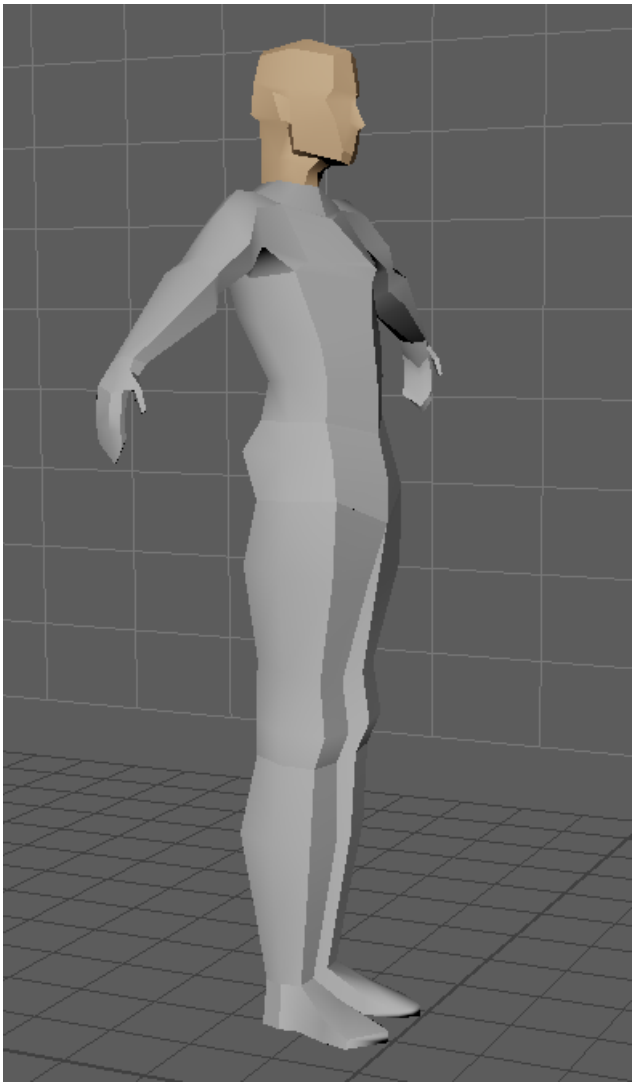

Figure 2.21 – Finished Complete Mesh ¾ View.

Figure 2.22 – Clothed Mesh

2.1.5 ATAT

The ATAT was started by modelling the basic shape of the parts using blueprints in figure 2.23. from there I could start adding in the details, most of the details were added by extruding across a face then extruding in or out from that face to add some depth into the model. The guns were very satisfying to model, they started from a cylinder on one face was extruded in then scaled down and was extruded out which makes it look like the guns barrel was attached to the head. I created some little details which were duplicated and attached to the side of the body using the snap together tool, however these where promptly taken of the ATAT as I found that each one had 100s of faces which made the program lag. Overall, I am happy with the way the ATAT came out the details are subtle but add so much to the overall look of the model.

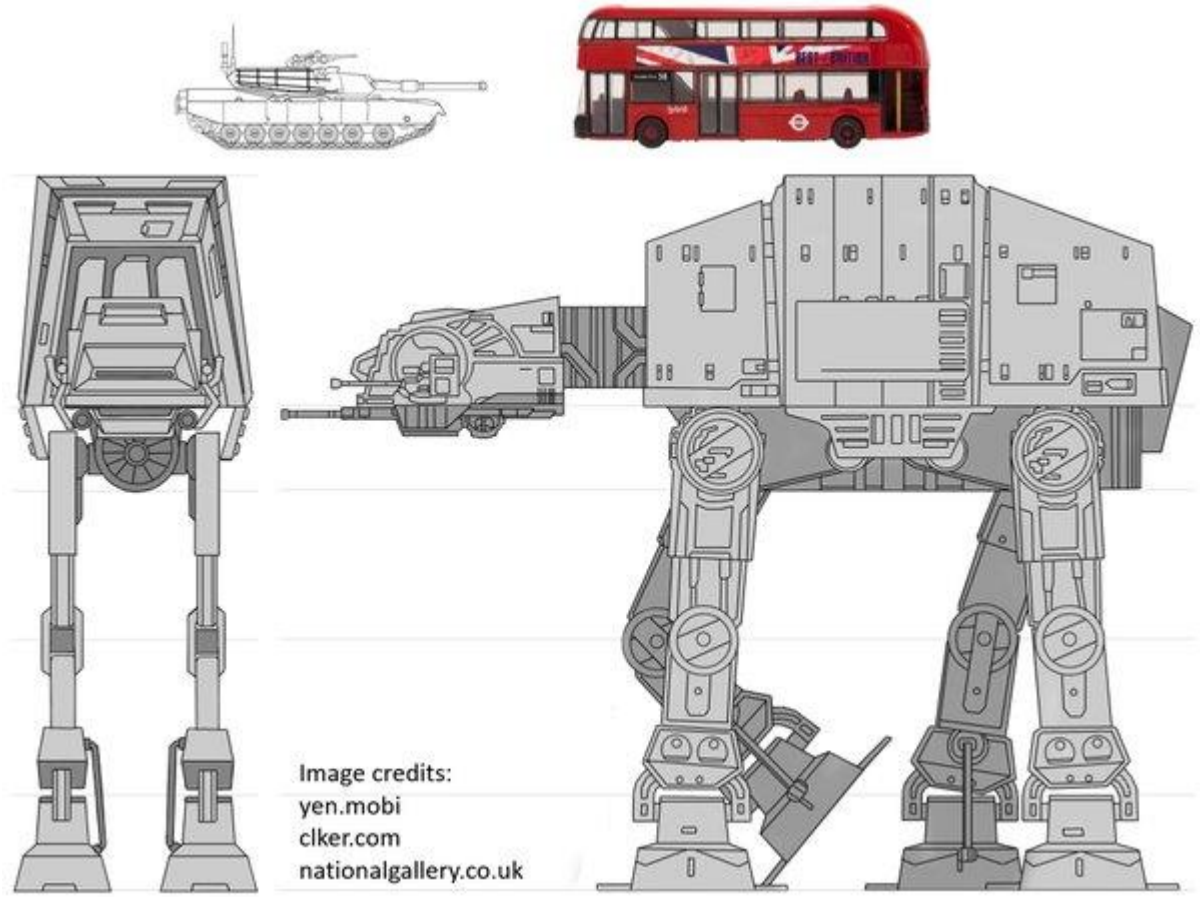

Figure 2.23 – ATAT Concept Art

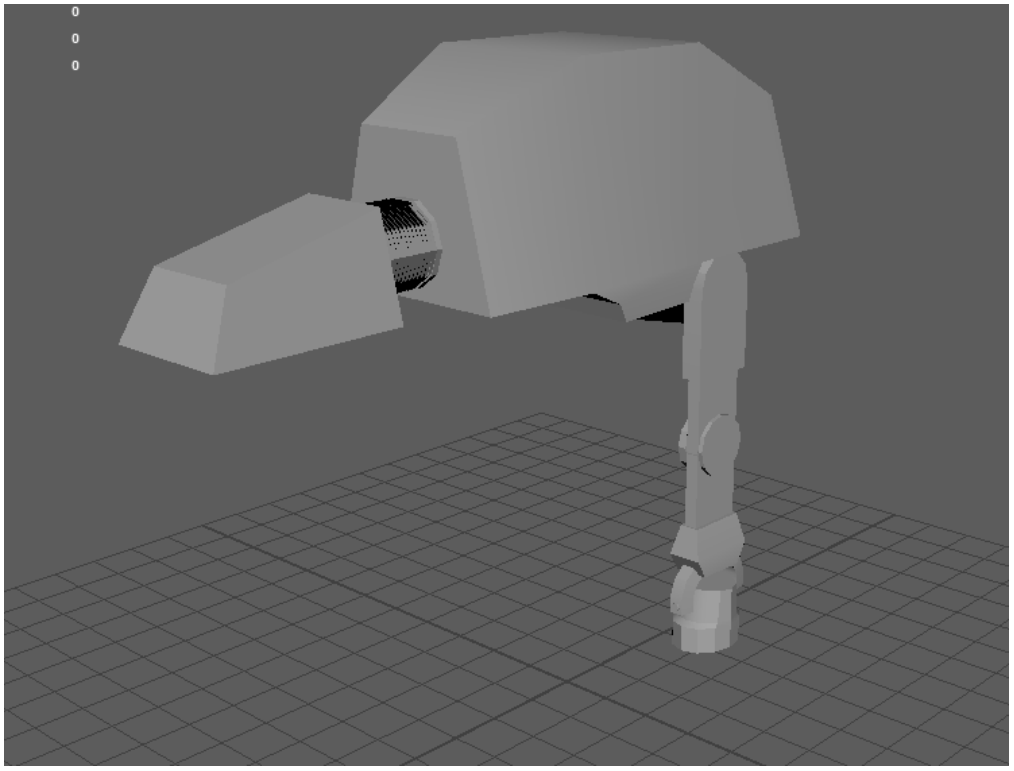

Figure 2.23 – ATAT Mesh in Construction

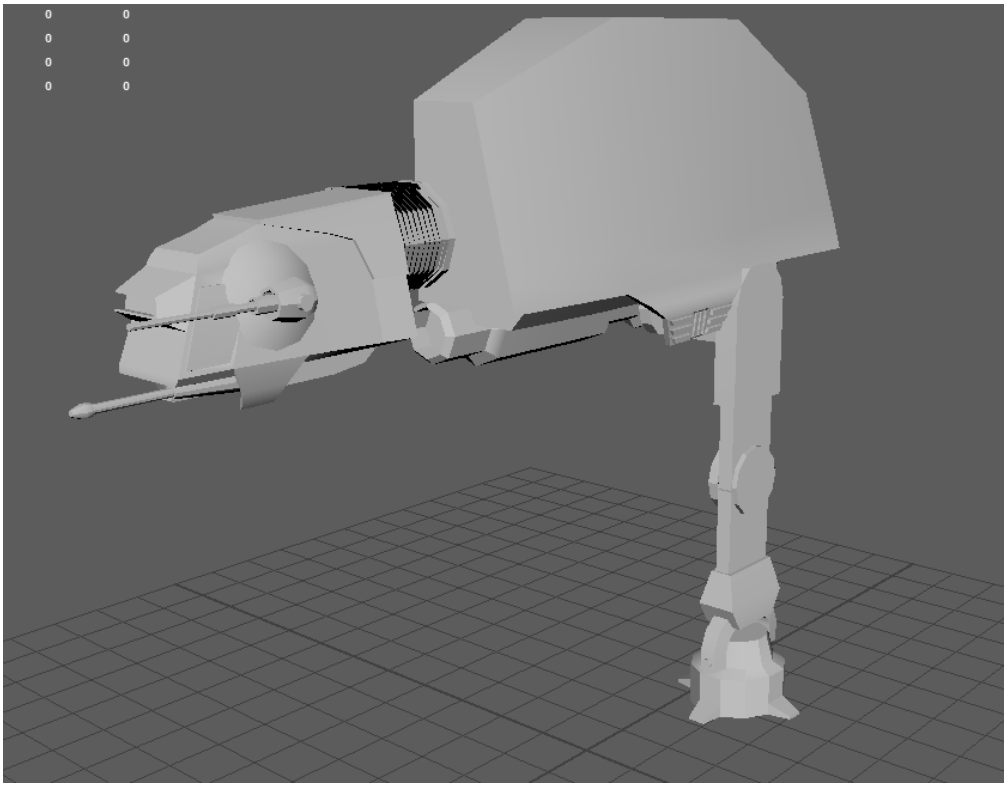

Figure 2.24 – ATAT Mesh in Construction

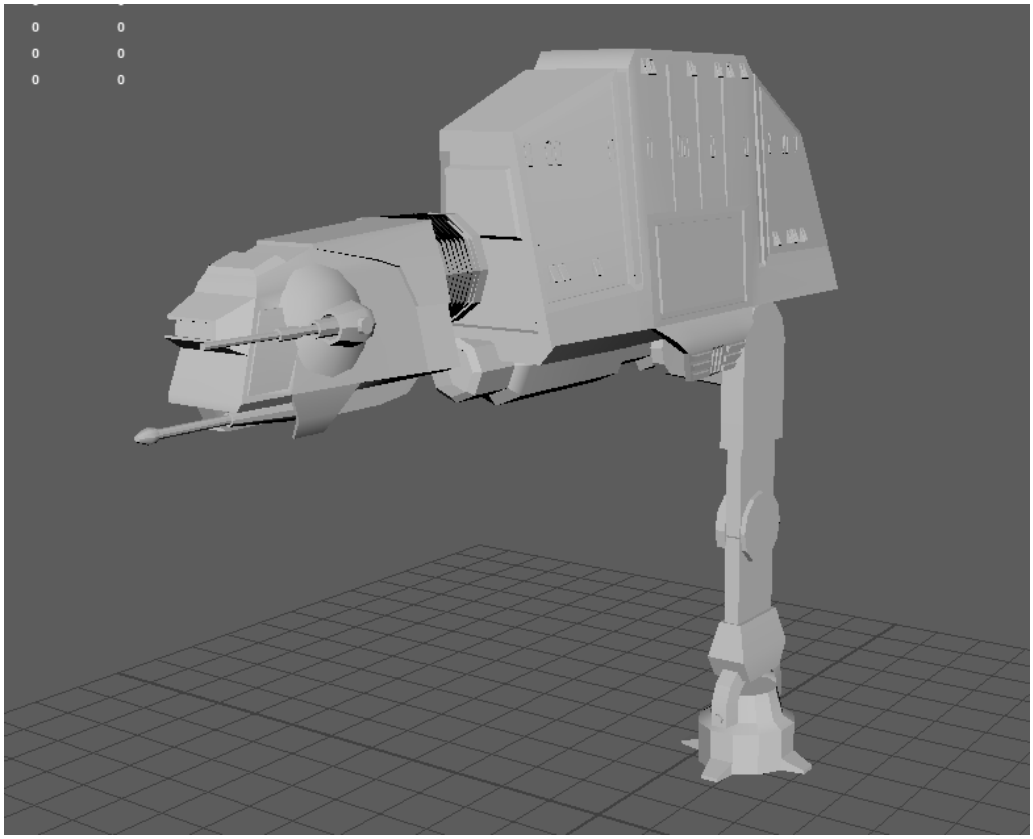

Figure 2.25 – ATAT Mesh in Construction

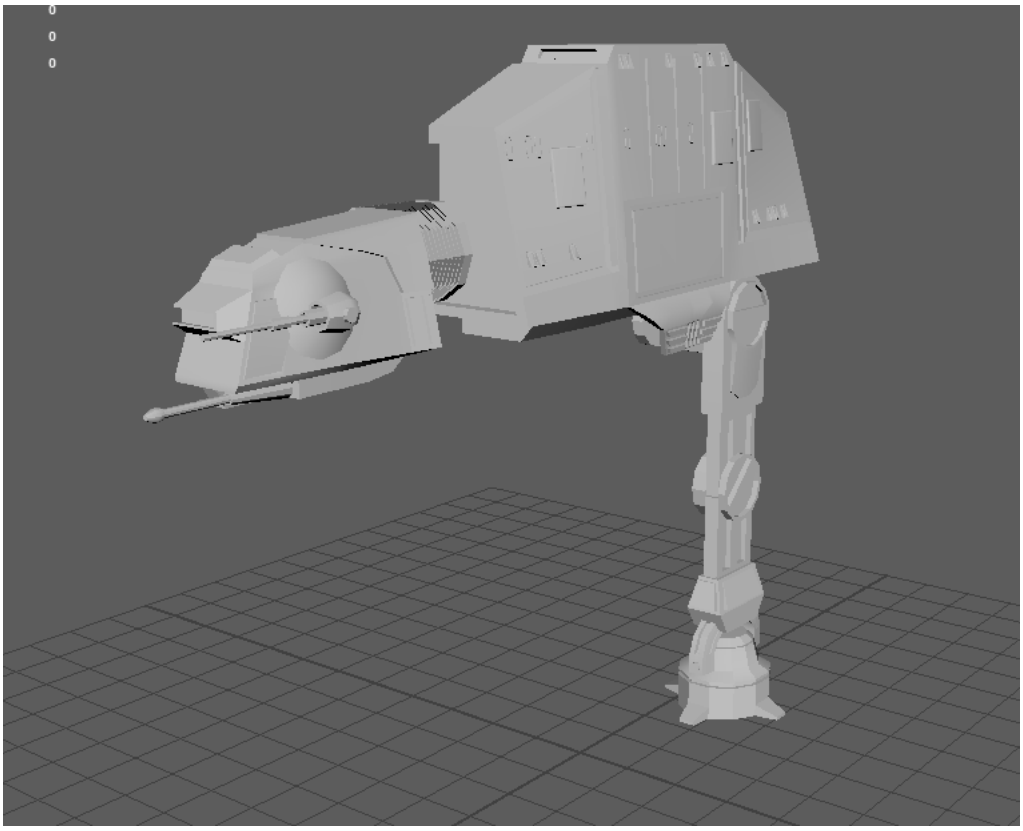

Figure 2.26 – ATAT Mesh in Construction

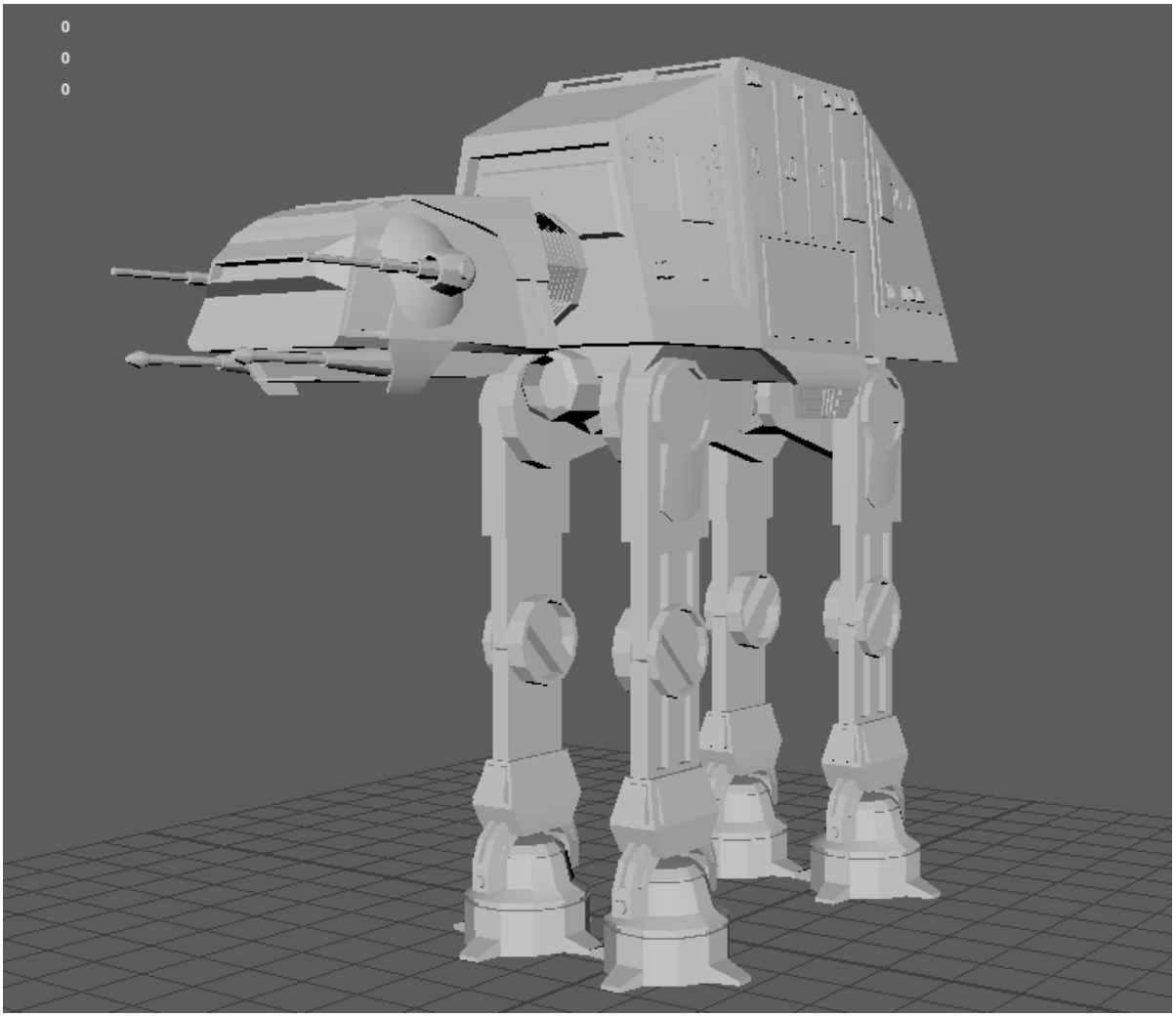

Figure 2.27 – ATAT Finished Mesh ¾ view

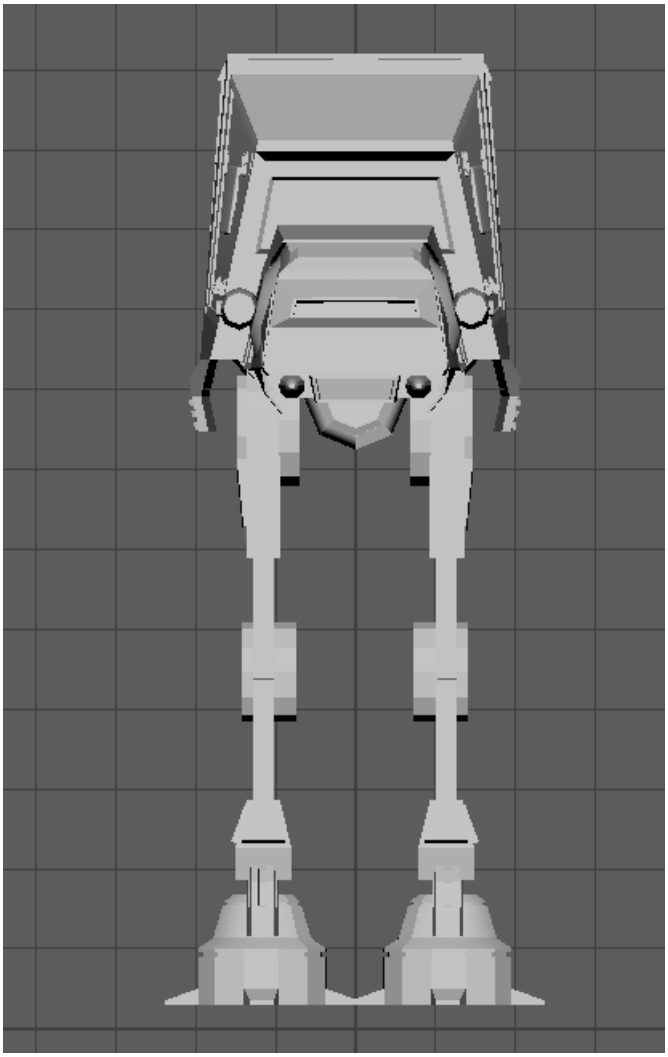

Figure 2.28 – ATAT Finished Mesh Front view

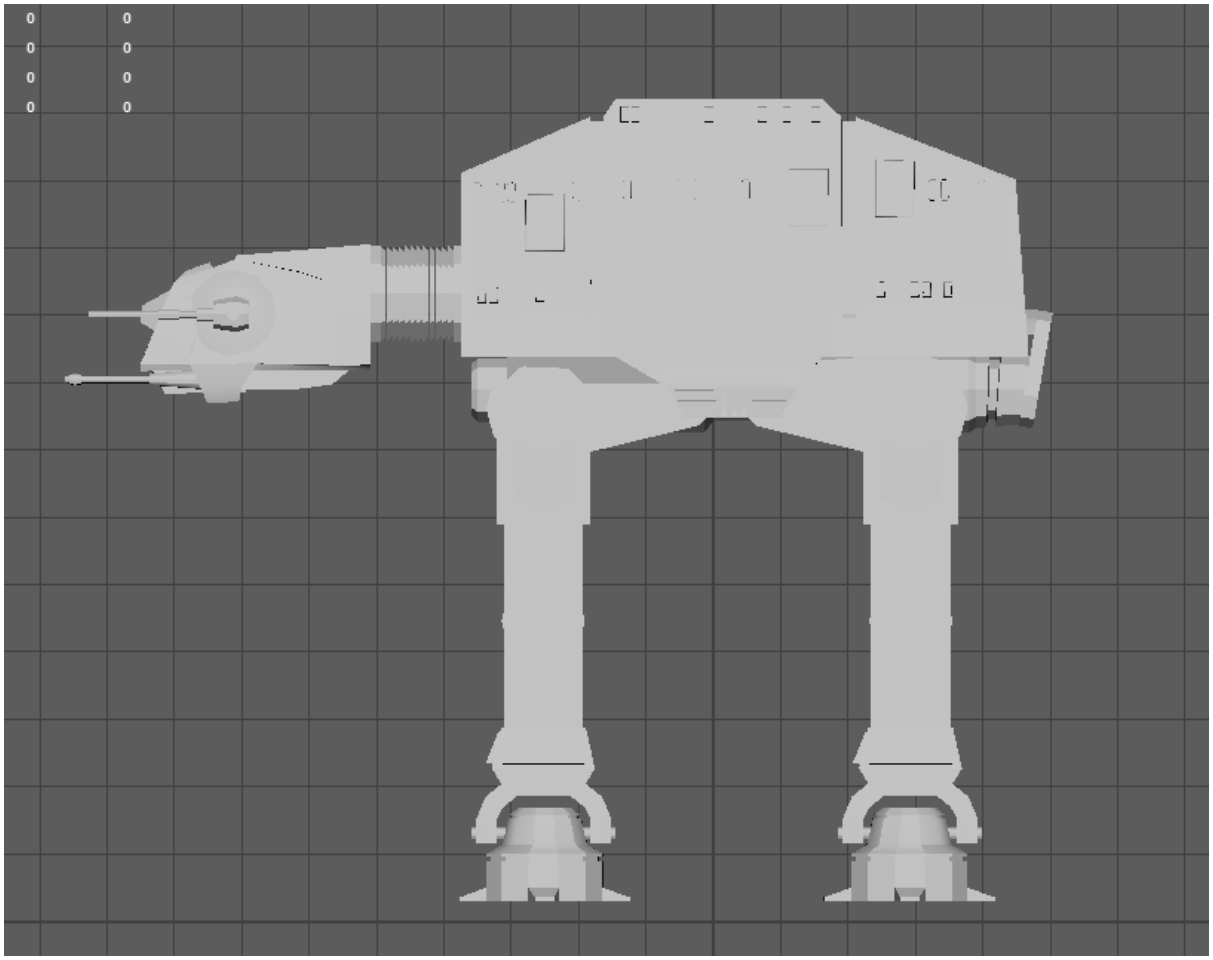

Figure 2.29 – ATAT Finished Mesh Side view

2.1.5 Turret

I based the turret of the Hoth Turrets shown in Star Wars I knew I wanted to keep it quite simple to prevent the increase of the number of faces as the ATAT had quite a lot. The turret was created from a cylinder with decreased subdivisions this was then extruded in and up into the turret shown in the screenshots. The turrets gun was made like the ATAT guns. Overall, I am happy with the simplicity of the geometry but also effectively creating a high-quality model. I think it could be improved by adding more little details onto the neck of the turret however I didn't want to get into the same problem with the ATAT by making little details with a high face count.

Figure 2.30 – Hoth Turret Concept Art

Figure 2.31 – Hoth Turret Finished Mesh ¾ view

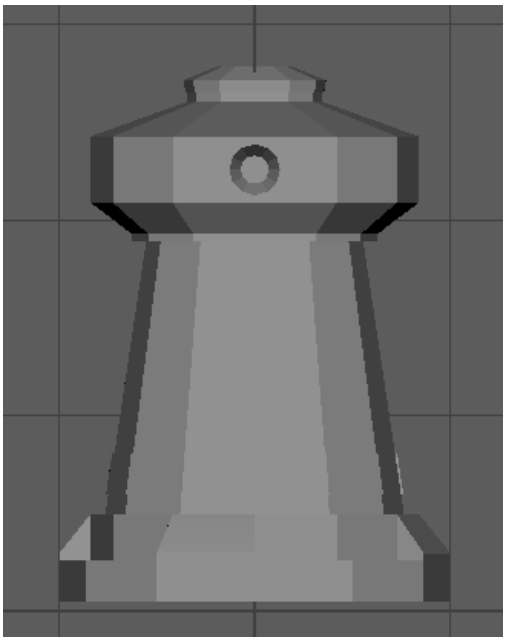

Figure 2.32 – Hoth Turret Finished Mesh Front view

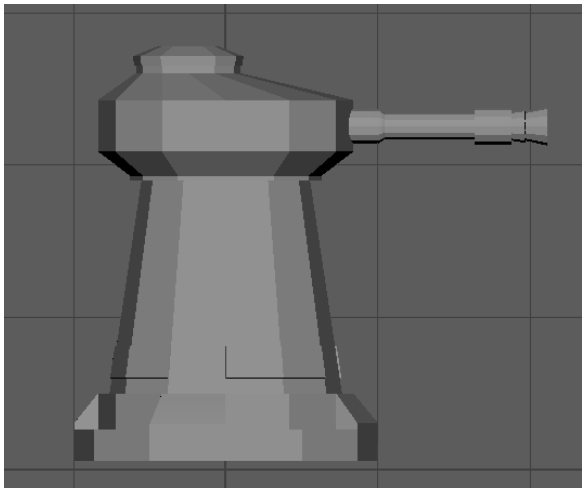

Figure 2.33 – Hoth Turret Finished Mesh Side view

2.1.6 Gun

The gun will be held in the hand of the character, I didn't need to put too much detail into the model as the player won't get a close enough look at it to see any details. So, I decided to use the outline of the concept art and model of that, with no need to add any little details. I think this came out great and effectively shows that it is a gun.

Figure 2.34 – Gun concept Art

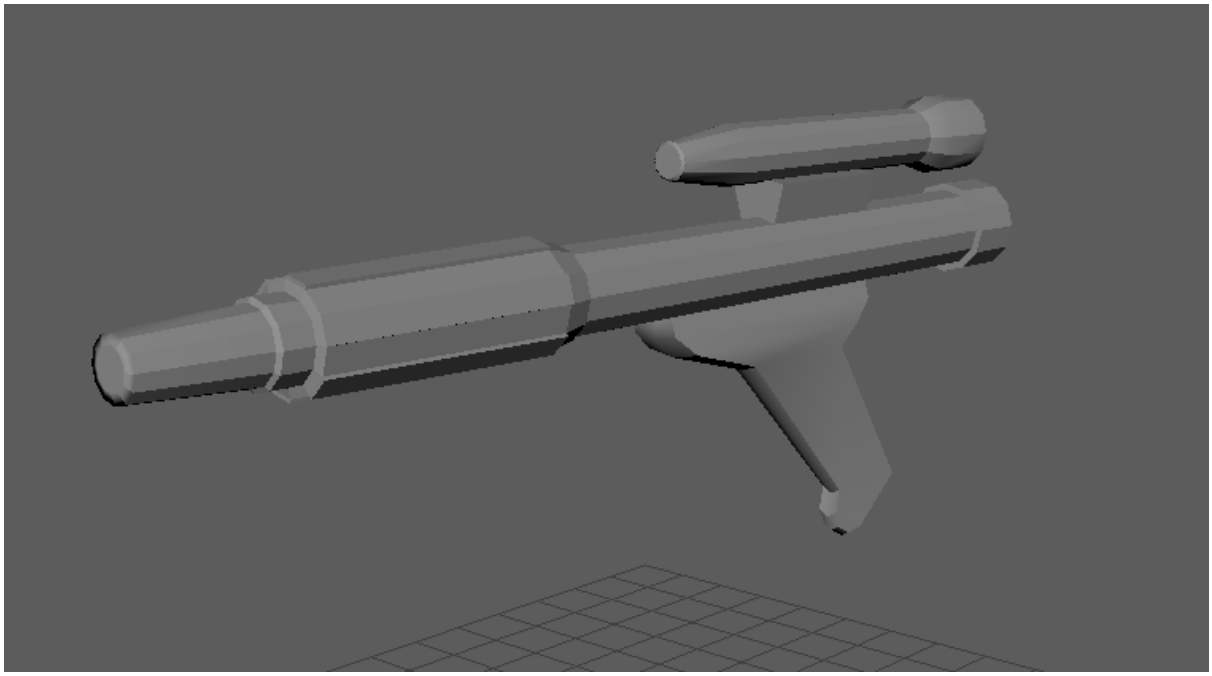

Figure 2.35 – Gun Finished Mesh ¾ view

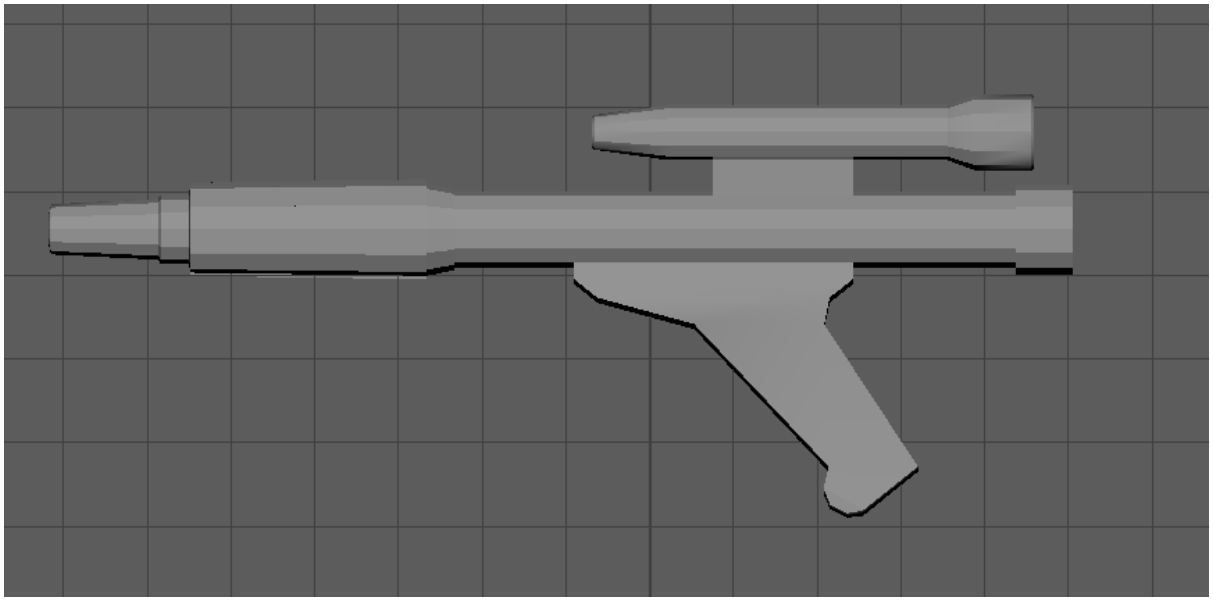

Figure 2.36 – Gun Finished Mesh Side view

2.1.7 Environment

The environment was made using the sculpt tool. A plain was created were I added more diversion a sculpt tool was used to create the high peaks then the strength was decreased to create the hilly environment around. To give the environment the low poly looks the plain was selected then retopologize, which turned the mesh into quads then the whole plan was triangulated where I could change the percentage of faces until I got to this stylised look.

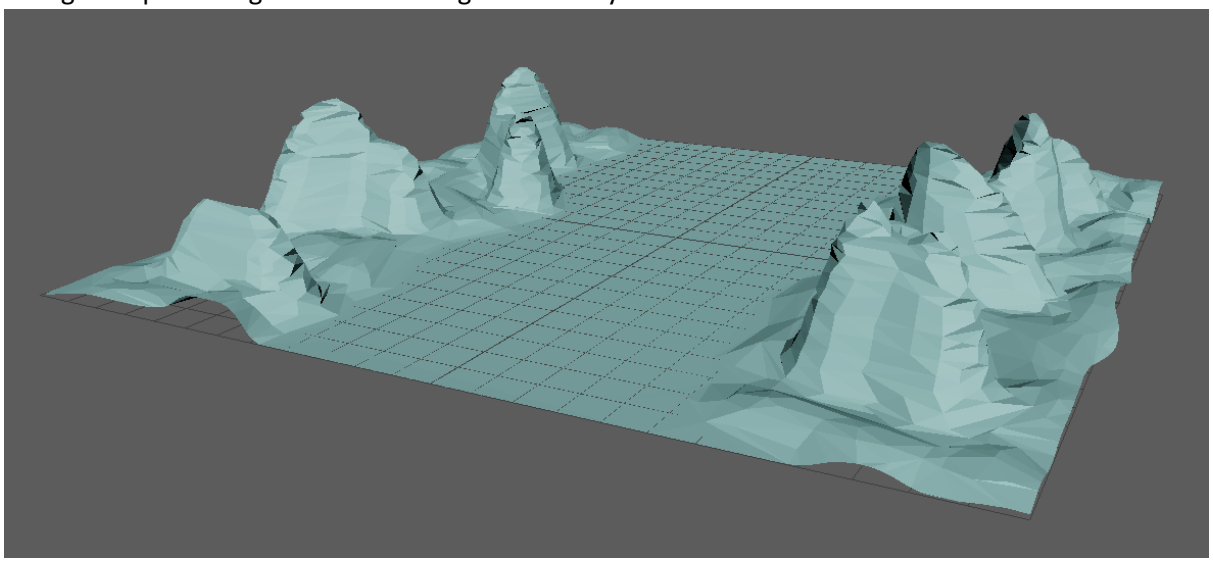

Figure 2.37 – Environment Finished Mesh

When I added everything to the scene in Unity, I felt it was quite bare, so I created some decorations to add around. The barrels were added to be obstacles and the floodlight was created to shine light onto the environment.

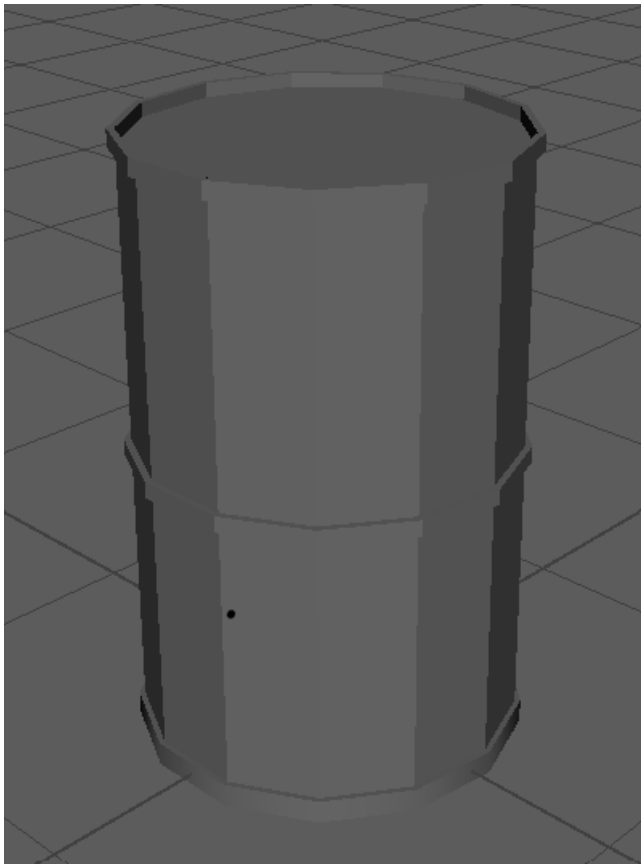

Figure 2.38 – Barrel Finished Mesh

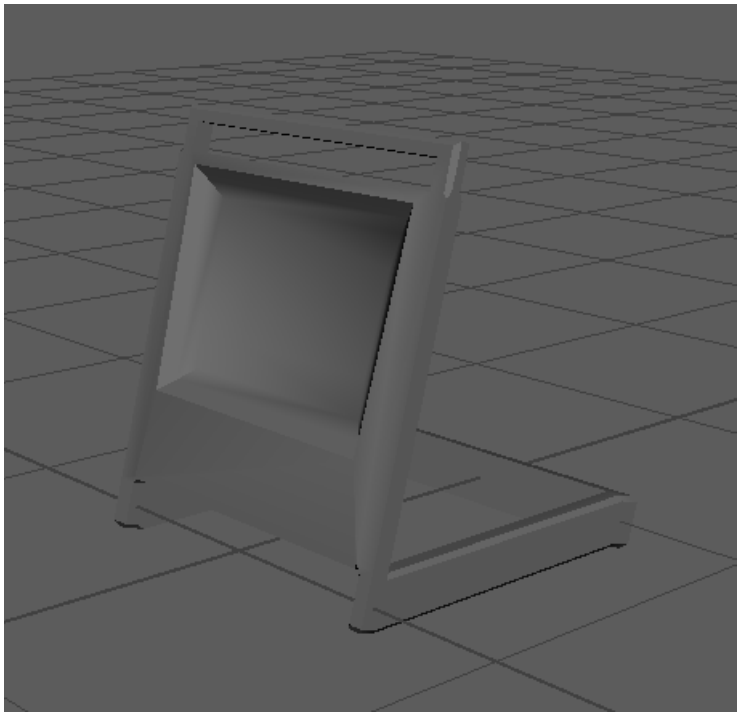

Figure 2.39 – Floodlight Finished Mesh

Section 3: UV Mapping and Texturing

3.1 UV Mapping

When creating the UV maps, I started off with using UV automatic to get the correct layout ready and by checking out the checkerboard view I checked for any deformation in the texture or places where a seam was clearly seen. To fix these I easily stitched or sew the edges together to get the overall shape of the model and laid them out so I can easily texture the model in substance.

When I created most of the models, I created half the model first and duplicated and flipped when I was finished. In hindsight I should have duplicated the model after I finished the UV map so the UV map would be duplicated over seamlessly. But as I didnt do this, I created the UV map for the whole geometry, in figure 3.1 as the sides of the body are symmetrical, I was able to overlap them in the UV map but because I created their UVs separately, they are not symmetrical, which might create some obscurities when it comes to textures.

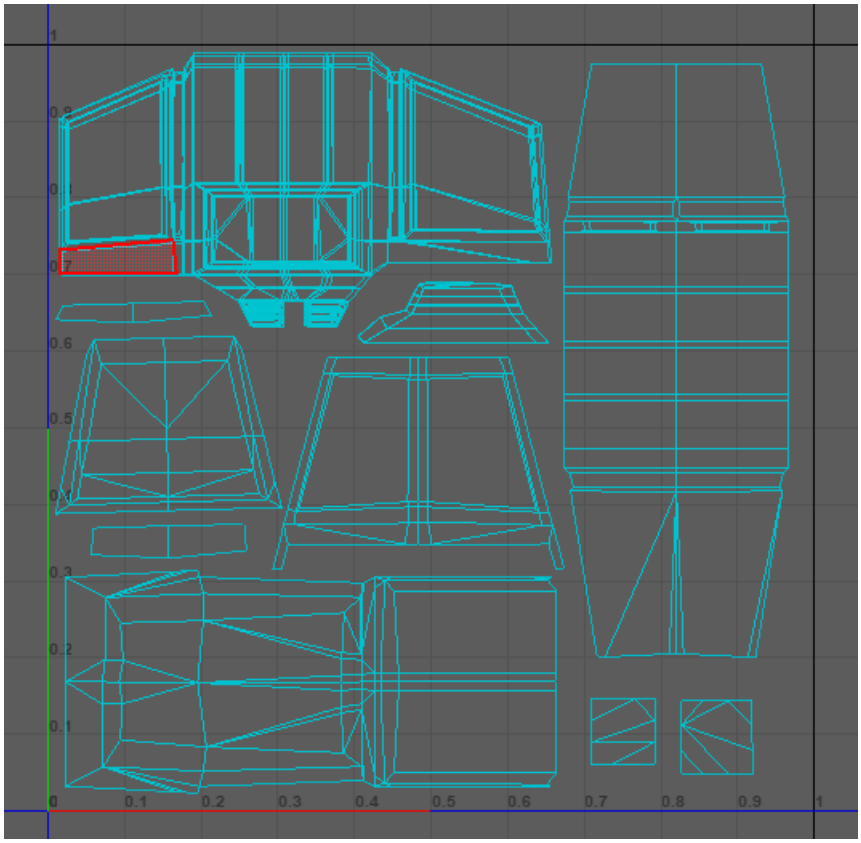

Figure 3.1 UV Map ATAT Body

3.2 Texturing

The game is set in a snowy environment so I knew I wanted my models to be covered in snow. However, there was not a snow texture, so I had to get a bit creative. Figure 3.2 is the design I have chosen, it started with a metal texture that was painted over by a black paint texture and to make the metal covered in snow I used a rust texture that was black masked over which was painted white. The black mask allowed me to scatter the rust across the model and get it right into the corners as the snow will find it difficult to get out of the corners.

I really enjoy the contrast between the black paint and the snow in figure 3.2, it could be improved If I had some burn marks throughout the model to show that it has been in battle and shot at by blasters. This could be done by adding some decals and printing them onto the body. If my game was not set on a snow planet, I would have probably gone with figure 3.4 as I like the glossy look of the paint making the model look quite stylised.

I textured the Turret the same way I textured the ATAT however I used blue paint as blue is considered a hero colour while Black is a Villain colour.

Figure 3.2 – Textured ATAT

Figure 3.3 – Textured ATAT

Figure 3.4 – Textured ATAT

Figure 3.5 – Textured ATAT

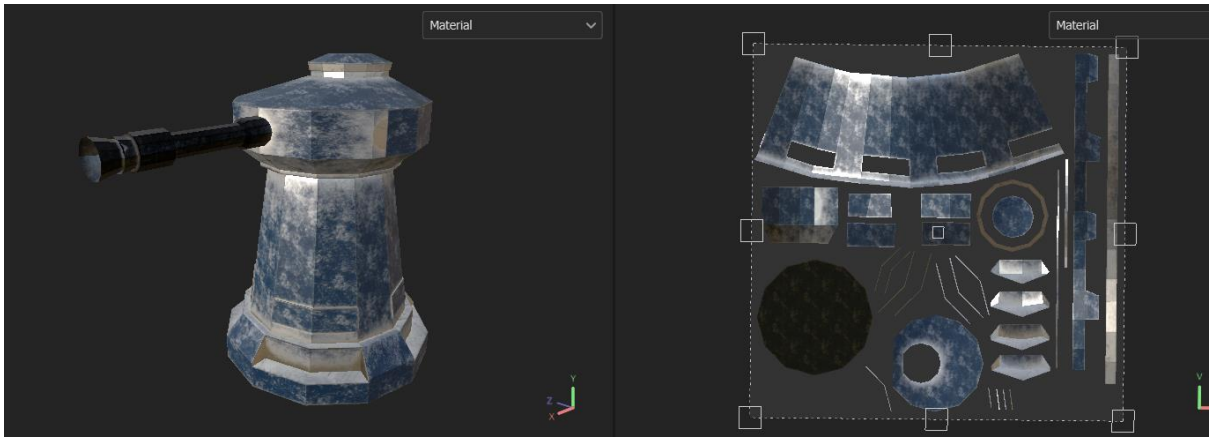

Figure 3.6 – Textured Hoth Turret

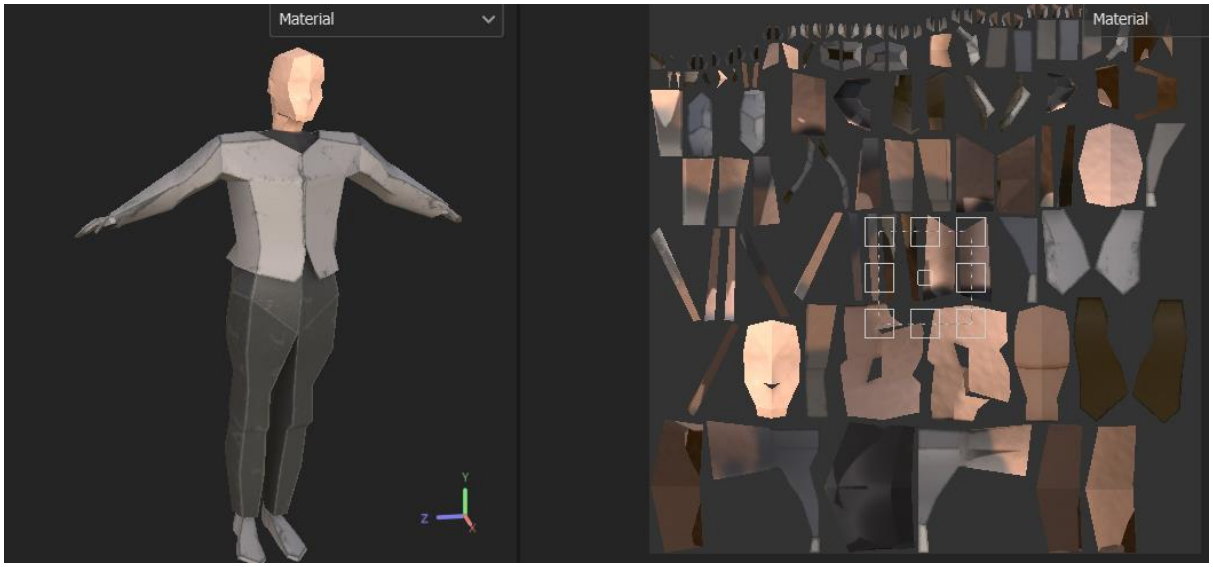

Figure 3.7 – Textured Soldier

Figure 3.8 – Textured Soldier

Figure 3.9 – Textured Soldier

Section 4: Rigging and Animating

4.1 Rigging Character

To rig the character, I used the Advanced Skeleton Rigging plugin. This was a very efficient and effective way to rig my character. I found the setup quite simple; it was a bit tricky to line up the bones effectively but when it was done the rig was very professional. I was able to create a walking animation by using the Walk Designer. This created a believable walk animation however the skin was getting pulled by the wrong joints because when the skin was bind to the mesh it messed the skin weights up. However, this was easily fixed by painting out the skin weights on the places where the skin was being pulled.

I also imported the gun model into this file and wanted the gun to be held and move with the character when it was walking. I first thought I could just parent it to the hand geometry however when the animation was played the gun never moves this is because the skin never actually moves but the rig does instead. So, I parented the gun to the elbow constraint, and this worked perfectly.

Using the rig for advanced Skeleton I was able to manipulate the character and create a crouching animation which transitions into a shooting animation that repeats continuously. The animation is ok I believe it could be improved by adding more keyframes to make the transitions a lot smoother also as the mesh doesn't have a lot of edges the limbs fold instead of bending correctly.

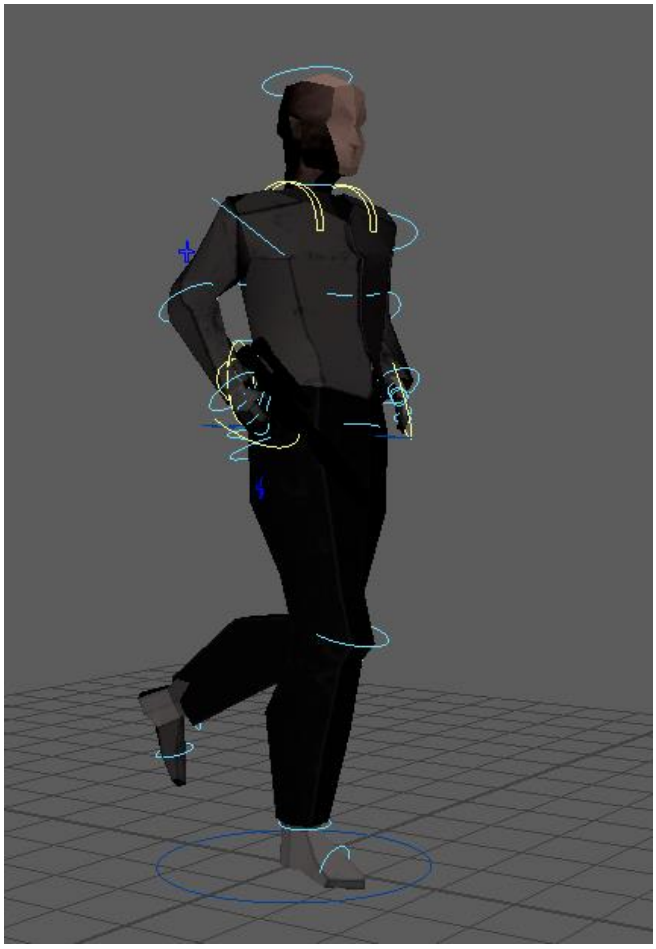

Figure 4.1 – Rigged Solider using advance rigging plugin

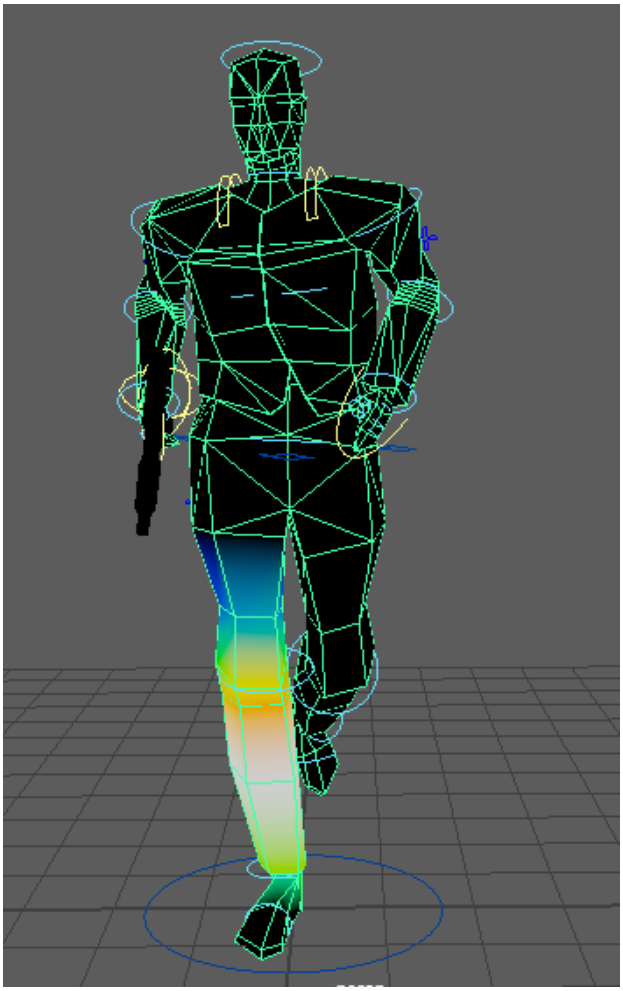

Figure 4.2 – Painting weights of soldier

4.2 Rigging ATAT

The main parts of the ATAT which I want to animate are the legs and head, the legs have been rigged up with a thigh, knee and foot joint and the neck has around 6 joints so it can bend properly. I added IK constraints for each leg however when I first did this the legs bent in the wrong direction this is because the software didn't know which way the legs bent as they were straight. To fix this I had to bend the legs in the correct way before applying the IK constraint. Nurbs circle were parented to the constraints to allow me to easily animate the object.

In maya I created a falling animation, to add some anticipation for the animation I made the leg repeat taking a step but then the leg slides backwards like it is tripping over which is the catalyst for the ATAT falling forward where its head finally stops the fall.

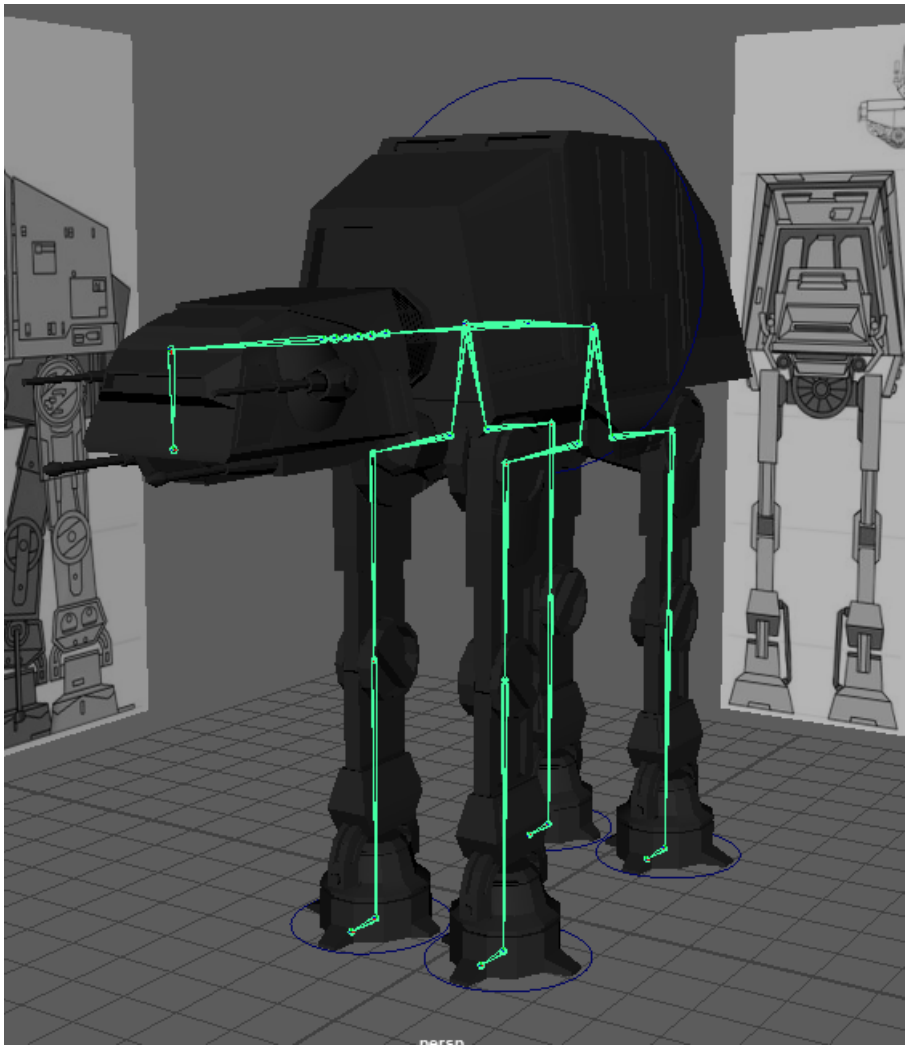

Figure 4.3 – ATAT Rigged

The walking animation was created in Unity using Procedural Animation, which is a way of animating using code rather than a predesigned keyframe animation. This creates some dynamic and unique animation. It is done by using the animation and rigging package in unity. A Rig is created for each leg where a constraint is added shown in figure 4.4, in this constraint the root, mid and tip bones are connected to the thigh, knee and foot joint to create the constraint. This is like the IK constraint in Maya. When the joints are plugged in a target and hint are created, the target is where the tip joint is connected too, and the hint is how the joints will rotate. This constraint is added to each individual leg.

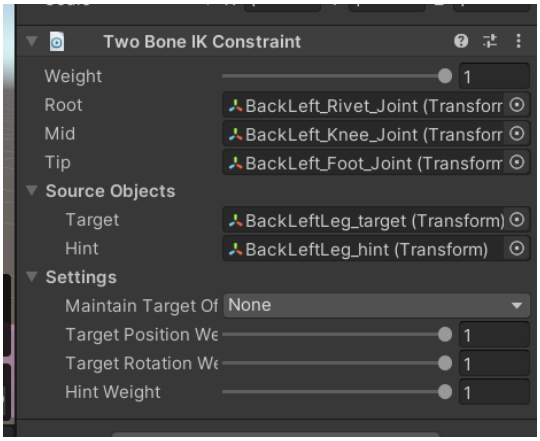

Figure 4.4 – Unity IK Constrain Script

Code is added to each Target where a ray cast is shot down from the target onto the environment this makes it so the foot is placed perfectly on the environment, so when the body of the ATAT move the legs stay still and don't move with the body shown in figure 4.5. To make the feet step with the body 4 new objects are created which are attached to the body of the ATAT rays are casted from these points and each one is allocated to a different foot. If the 4 new objects attached to the body get too far away from the legs the feet, the feet will move towards the new points creating the illusion that it is walking.

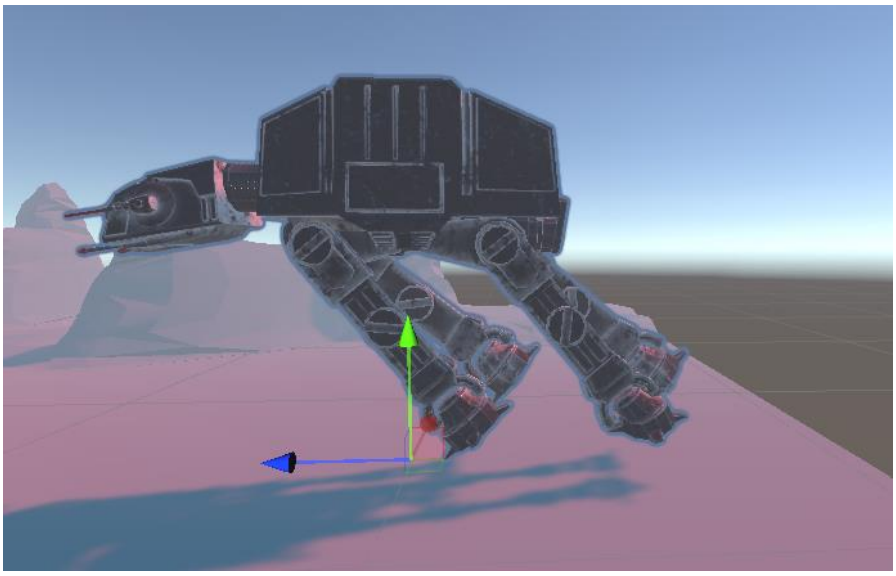

Figure 4.5 – Showing feet being stuck to a point

Using the ncloth animation I was able to create a satisfying death animation where the ATAT blows up. It was created by turning the mesh into a nlcoth and adding a tearable constraint onto the body. I then added an emitter inside the body which quickly filled up with particles and when it got too full it teared through the body of the ATAT creating an explosion like effect. The nucleus gravity was set to 0 this allowed the pieces of the model to fly out exaggeratedly into the air then I keyframed the gravity to gradually increase to 9.8 to make all the pieces drop to the ground. I used this same method to create a explosion animation for the turret but in that I also used a radial field which quickly forced all the particles out creating a more spectacular explosion.

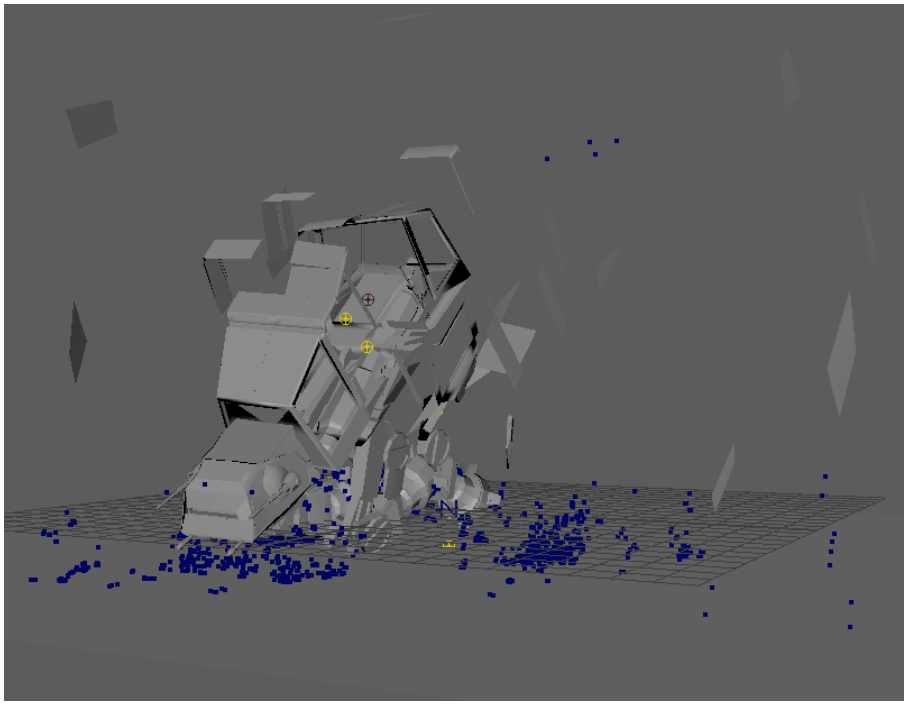

Figure 4.6 – ATAT nCloth Explosion

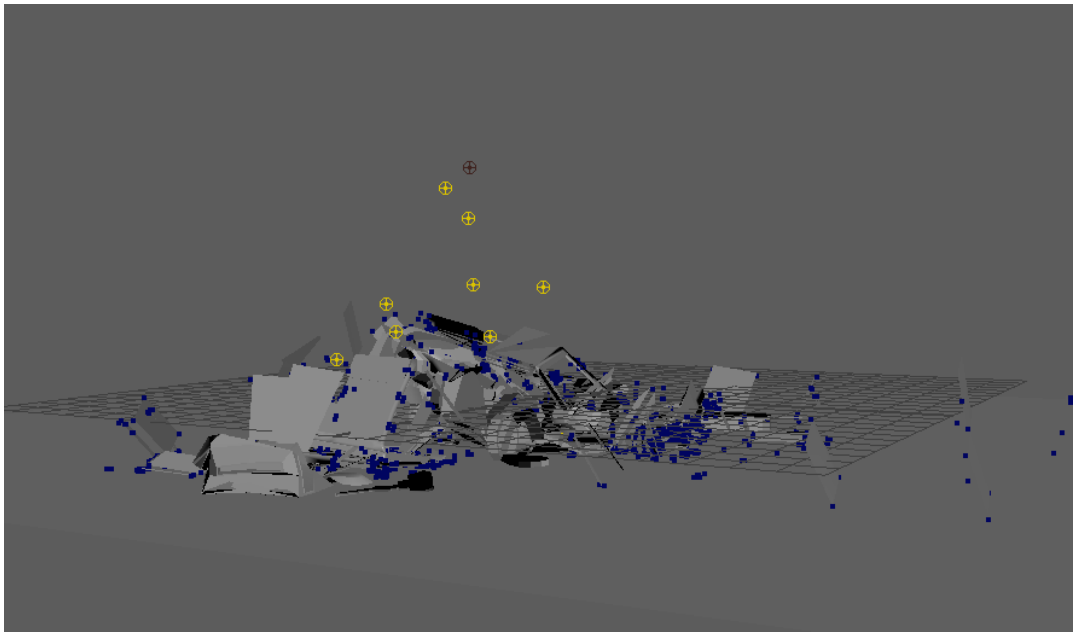

Figure 4.7 – ATAT nCloth Explosion

4.2.1 Explosion Demo Videos

ATAT Explosion – https://youtu.be/tQP45O7ihYc

Turret Explosion - https://youtu.be/C6cqHK1Q4nA

4.3 Rigging Turret

The rig for the Turret was made of 2 joints the main one is the head joint which moves the turrets head 360 degrees. I did not animate the turret as I wanted to animate it in unity using a multi aim constraint shown in figure 4.9 where it takes the joint I want to constrain and the object it wants to look at and when play mode is enable that joint will always look at the chosen object. this allows it to dynamically look around the game without the need for animation.

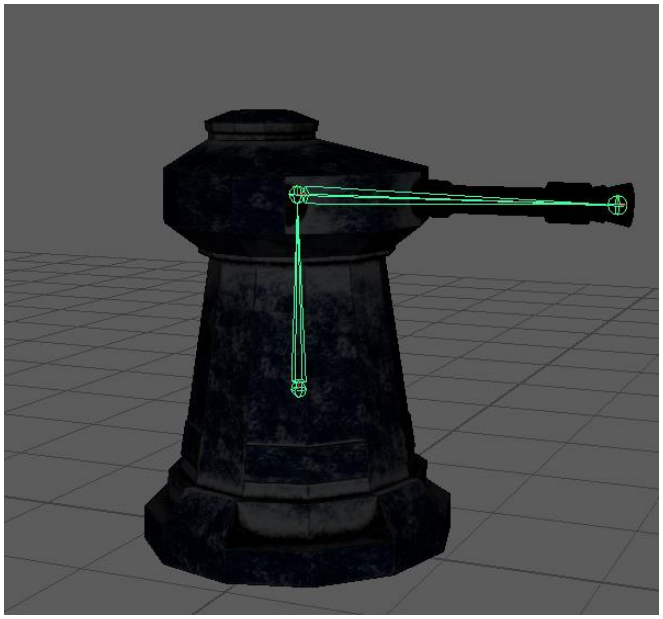

Figure 4.8 – Rigged Hoth Tuuret

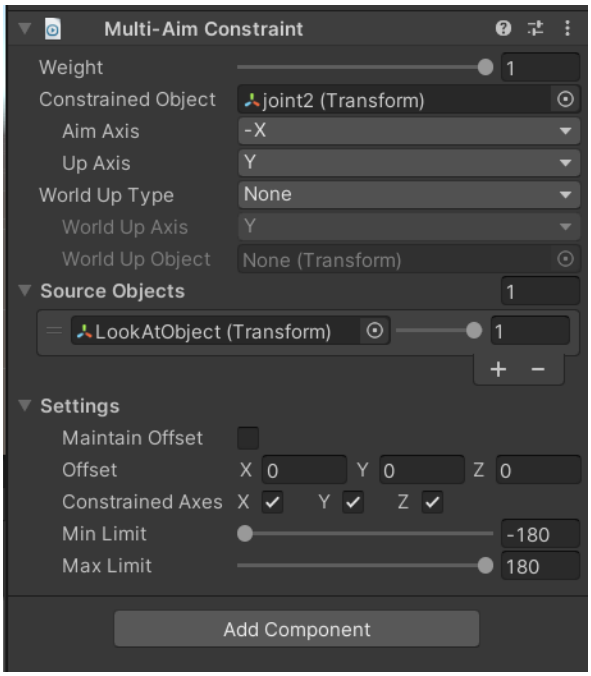

Figure 4.9 – Aim constraint in Unity

Section 5: Conclusion Critical Review

5.1 The Good

5.1.1 The models

I believe the models are at a very high standard, effectively resembling what they should be with a high amount of detail included. However, while modelling I need to consider the Ngons being produced and the non-manifold geometry as this gave me problems when I tried to export to substance painter. This was easy fixed by using the clean-up tool too highlight where the Ngons are which were easily fixed by triangulating the faces then quadrangulate to create 4 side faces.

5.1.2 The Textures

The textures produced for my model were very effective, I particular like the rust textures scattered across some of the models that was painted white to create a snow effect. The textures could be improved with the inclusion of decals for instant on the ATAT I could paint on bullet holes decal to show that it has been in battle. Also, I could paint on button decals to the character model to add more details.

5.1.3 nCloth Animation

The nCloth animation was very enjoyable to make the use of a tearable constraint creates a stunning and believable explosion like effect. To improve it I should of increased the particles velocity as they spawn to create a sudden burst of particles which will help make parts of the model fly up into the air. Also, the use of smoke and fire particle effects could help enhance the realism of the explosion however with the combination of the tearable effects I don't think my computer could handle all the particles.

5.2 The Improvements

5.2.1 UV Mapping

I believe the UV maps that I have create are at a high standard, however the workstream to create them wasn't very efficient. When I was modelling my assets, I modelled half and then duplicated and flipped to get the whole build. I should have done this after I finished the UV Map as they get transferred to the duplicate object, this would of saved me a lot of time as I had to do twice as much work to UV Map all the models.

5.2.3 The Animation

The animation for the Character running and the procedural animation added to the ATAT are very impressive and I am happy with the outcome. But I think the ATAT falling animation and the character crouching and shooting animation could be improved greatly. Right now, they feel very robotic and not smooth at all this could be improved by adding keyframes in between the originals keyframes to make a smooth transition during the animations. Also, the models should have more edges were the main joints are to allow the mesh to bend more realistically.

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Appendix

Substance Painter Renders