COMS30059 CGI Report

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Introduction

The project for this unit is to model own Olympoid character and animate it. The first decision was to do figure skating Olympic sport because it was graceful. However, the movement was too difficult to achieve high reduction, so the final decision was weightlifting sport. Although the animation of weightlifting is simple, many movement details cannot be ignored when watching the video of weightlifters, such as the movement changes of knees and arms.

Weightlifting requires strong athletes, so Olympoid is designed to look strong. League of Legends has a champion name Blitzcrank, a robot with giant hands. A vast hand has a strong sense of impact on the vision, which makes the Hands look strong, so Blitzcrank is used as an Olympoid model for reference. The image below shows the Blitzcrank as the reference.

[1]

Image1: The reference named Blitzcrank

Modelling Design

It is not easy to find a blueprint of Blitzcracnk. Therefore, the modelling part will not use the image plane to import drawings and photos to design.

Head

Design the Head first. Edges of the Head need to be smooth, so the *Bevel* function was selected. Bevel was used for the four edges above the Head, with section 9. Bevel for the left and right edges of the lower Head, with section 10.

[1] Image from Blitzcrank (Character) | League of Legends Wiki | Fandom

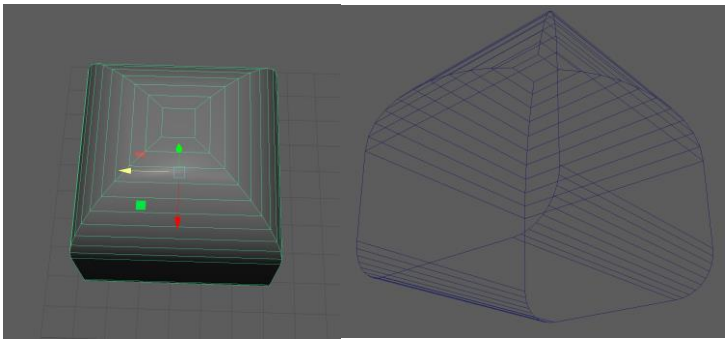


Image2: The top and bottom of the Head

Next was the eyes. The eyeball used simple spheres, and the eye socket used two cylinders for the *Boolean Difference* function. Both eyes' sizes were different, and they looked cute.

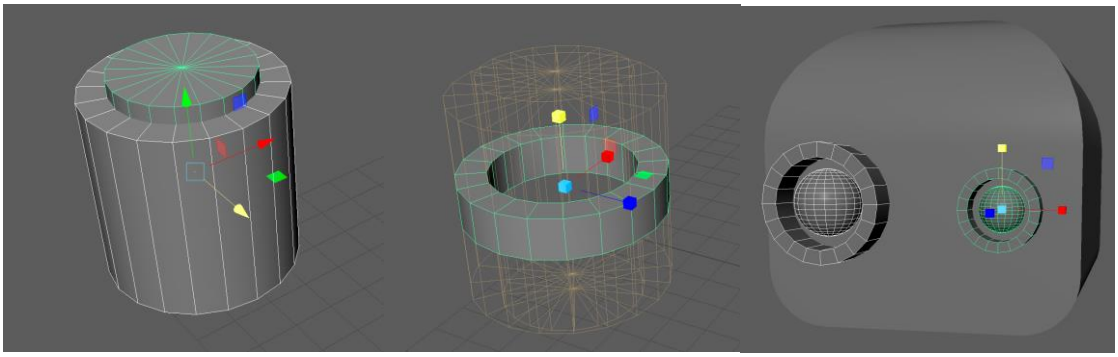


Image3: Eye part design

Added a narrow plane in the middle of the Head for decoration. Drew a curve around the Head and duplicated it, which used CV curves and the *Loft* function with default settings. Control vertices are used to move when part of the Plane is not exposed.

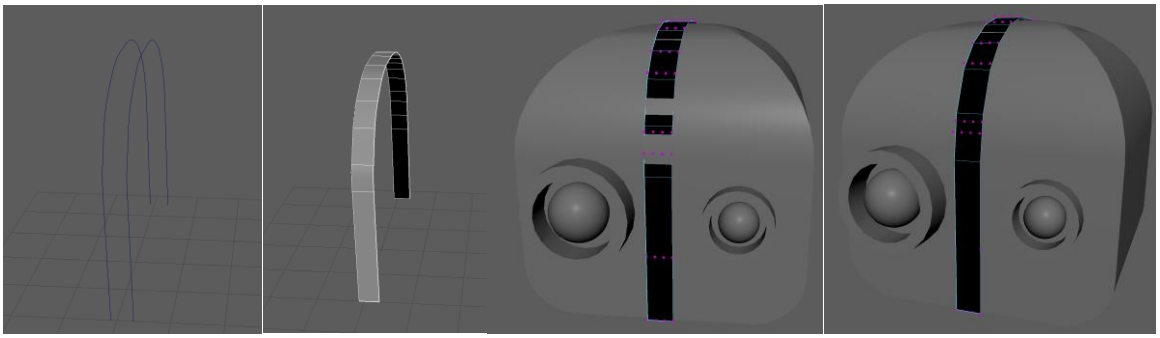


Image3: Plane decoration design

Main Body

The neck part used a polygon cylinder and used Add Divisions function with level 2 and transformed (translated and scaled) its faces and edges. The main body part chose a polygon sphere. It also used *Add Divisions* function with level 1, and specific faces were *Extruded* to add additional structure. The lower part of the main body used the Move tool to translate the faces.

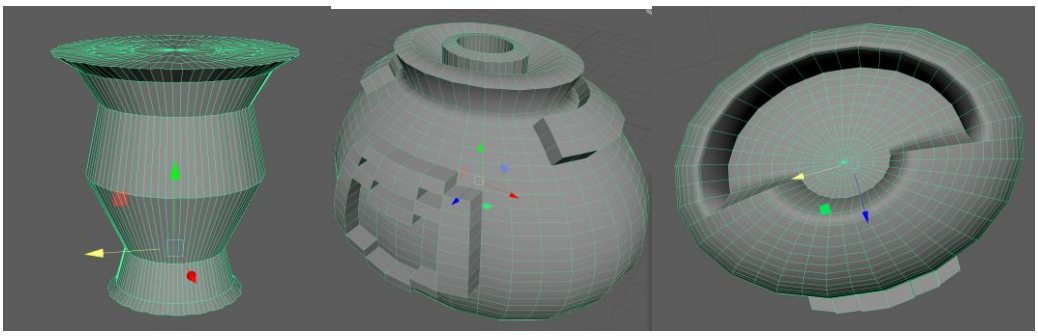
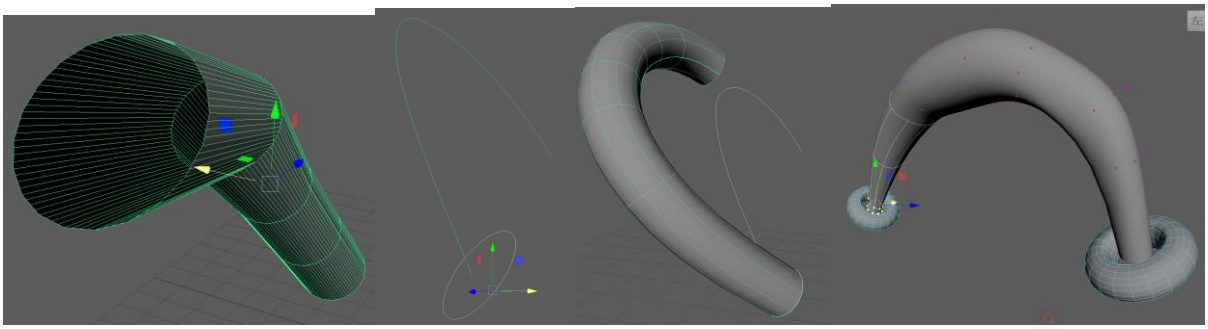


Image4: Neck and Main Body design

For this Olympoid, it needs an air cylinder and pipe to release energy. Air cylinder selected Polygon Cylinder as the base model, rotated and scaled specific faces after *adding divisions*, and deleted the top face. The pipe used two polygon torus as the base, and the main part used a circle curve and CV curve to *surfaces extrude*. The resulting circle pipe cannot connect to the polygon torus perfectly, so control vertices are needed to move the vertices to match the polygon torus. Duplicated these models and put them in the appropriate position to form the main body.



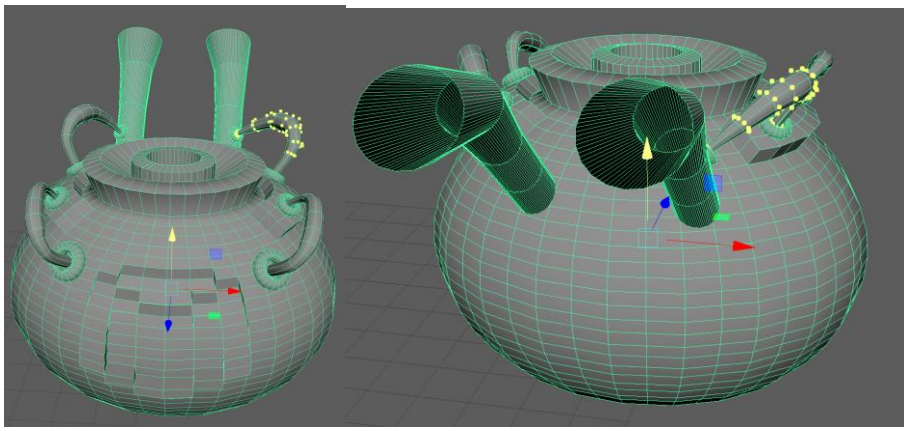


Image5: Air Cylinder, Pipe design and Completed Main Body

The lower body part took three polygon cylinders and using Transform tool for their edges, faces and vertices. A *Boolean Union* function is used in two cylinders to make it look good.

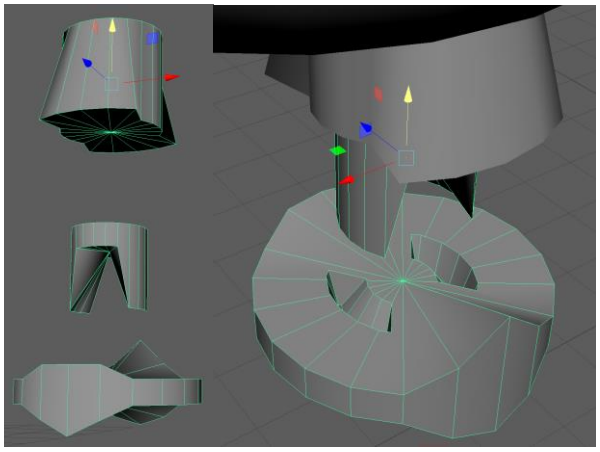


Image6: Low Body Part Design

Arm and Hand

The Arm used previous features such as *Bevel* and *Surface Extrude*, etc. Pipe on Arm was implemented in the same way as mentioned earlier.

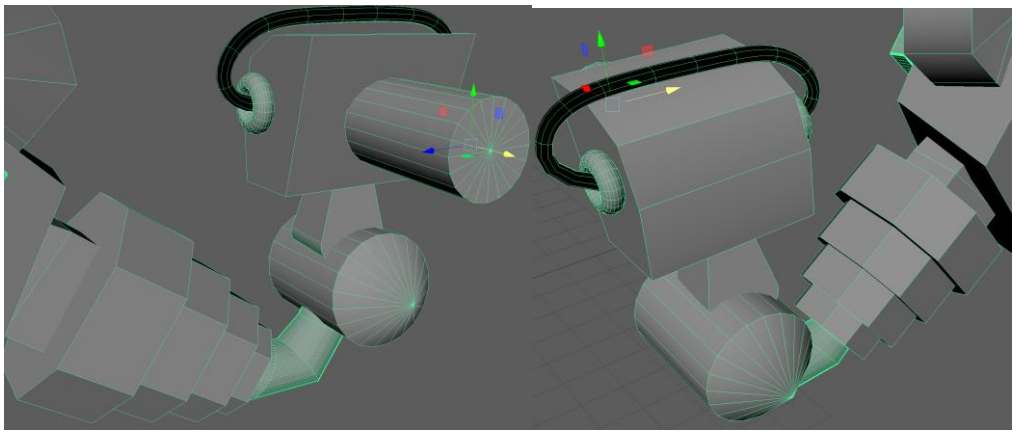


Image7: Arm Design

The design of the Hand is complicated. The thumb used the *wedge* function to show the curvature and then used the *extrude* to extend. Many joint models are added to other fingers to facilitate movements. There were many details between joints and fingers, and it was clear that the fingers surrounded the joints.

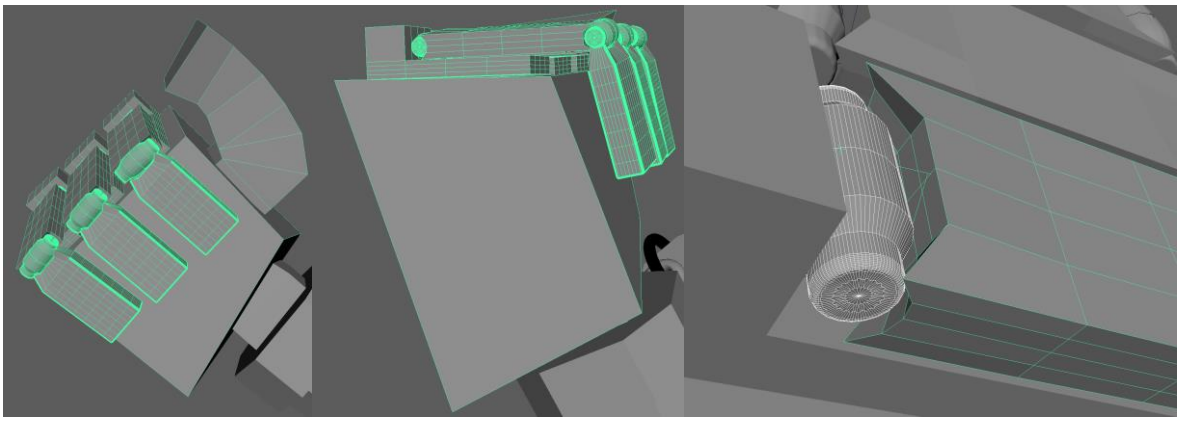


Image8: Hand Design

Once the Arm and Hand were created, it is necessary to use *Duplicate Special* to get the mirrored version. Set geometry type to Copy. If it is an Instance, the two models will change synchronously. Finally, set to -1 for the X Scale to get the mirrored model.

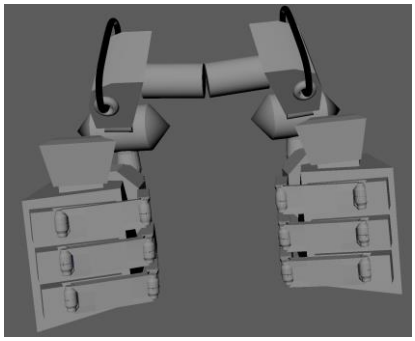


Image9: Another Hand and Arm through Duplicate Special

Leg and Foot

The Leg chose four polygon cylinders and used the Transform tool to adjust the joints.
Joint details between the Foot and Leg were also added. The Foot was adjusted by *bevel*, *extrude*, *add divisions* and other functions to show more details, especially for the toes.

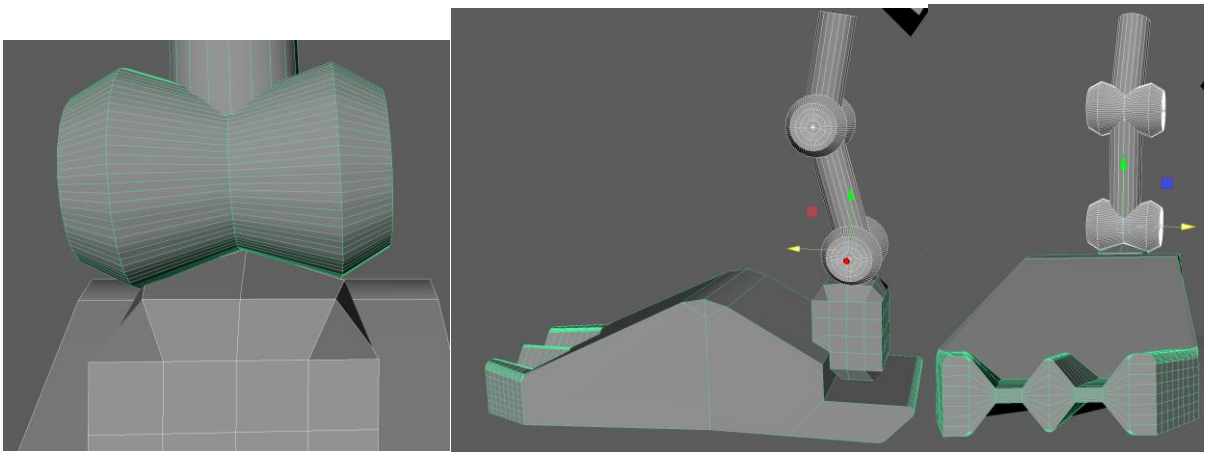


Image10: Leg and Foot Design

When models were constructed, they were combined and parented. The below image shows the full Olympoid.

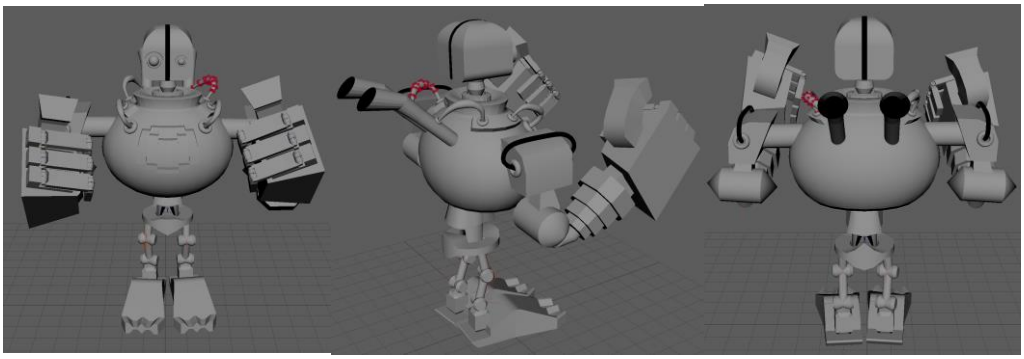


Image11: Olympoid

Barbell's polygon is relatively simple. Its polygons are all cylinders, and an appropriate scale can obtain a complete model.

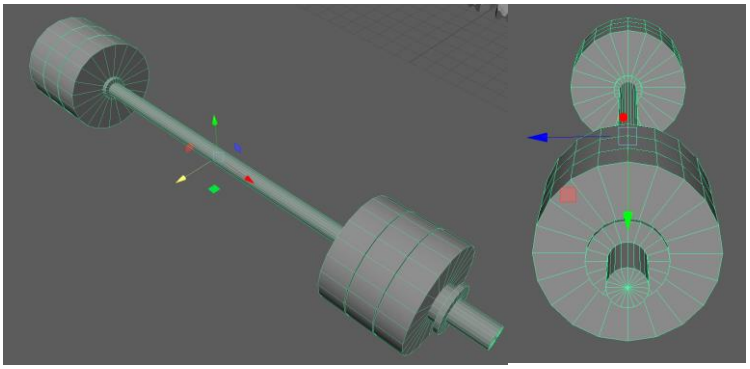


Image12: The Barbell Design

Animation Design

Joint and IK Handle

Before setting up the animation, creating *joints* for the Olympoid's torso is necessary. The *IK Handle* was placed on its main motion joints (Arms and Legs) to set keyframes to make better motion predictions. The default IK Handle was *Rotate-Plane Solver* that contains a white arrow and circle plane, but the motion for Arms and Legs did not need roration transform, so IK Handle was chosen as the *Single-Chain Solver*, which is more straightforward. Set the joints of the IK Handle not to form a straight line so that the bending can generate a triangle and a complete motion trajectory for the IK Handle.

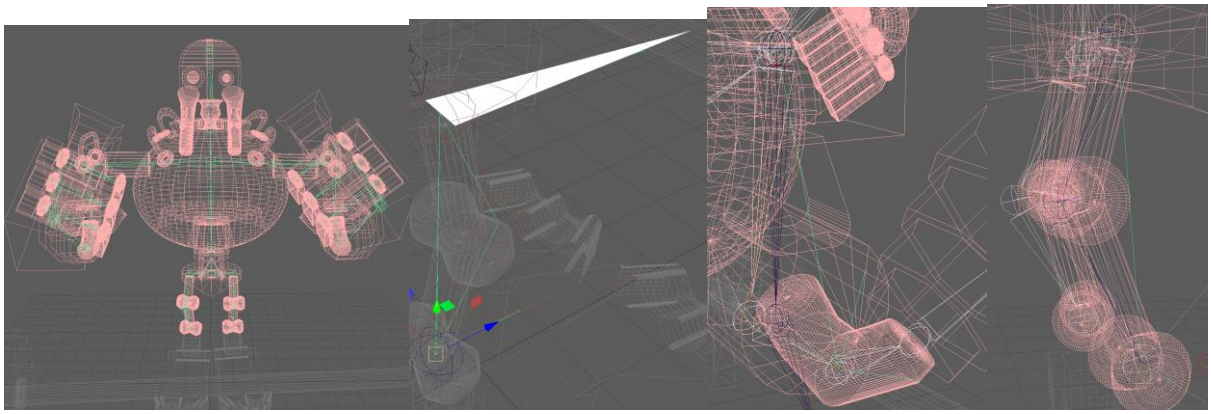


Image12: Joints and IK Handle Design

Polygons were set parent to joints to ensure that they could be transformed together.

Fingers also needed to be set up with joints. Polygon deformation may occur if transformation by the polygon itself.

When the Foot is set *joint* with the Leg, the Foot's movement will appear irregular motion. If the Foot needs to move with the Leg without extra movement, the nearest *joint* on the Leg is required to perform *point constrain* with the Foot. Then click the maintain offset to maintain the distance between objects and apply it to achieve the effect.

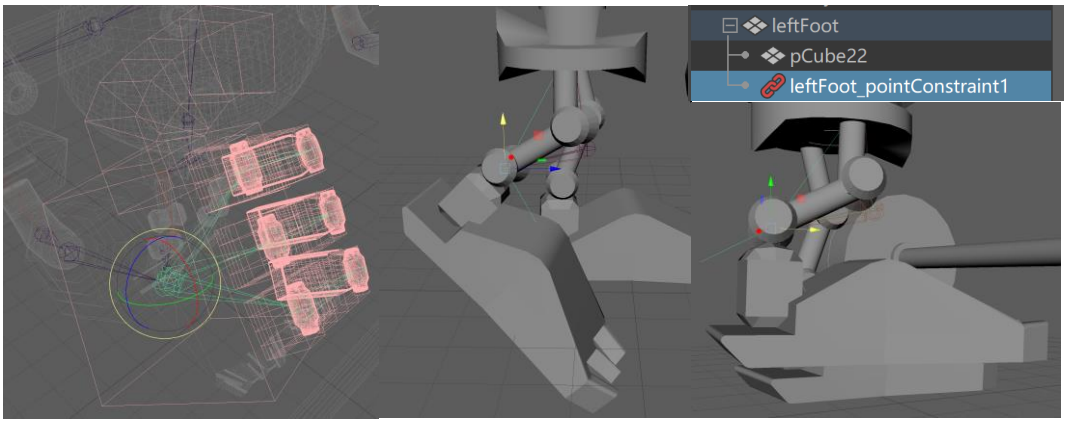


Image13: Fingers with Joints, Foot with joint and Foot with Constrain

Set Keyframes to make Animation

The IK Handle of the Arm will make irregular motion predictions, such as twisted rotation, when setting the animation to move forward. Rotation is not required when moving forward, so set *Limit Information for Rotate* in Attribute Editor of the Arm's IK Handle in the first keyframe to keep it in the rotation position of the first frame. It is also possible to pull the rotational motion into a straight line in the *Graph Editor*.

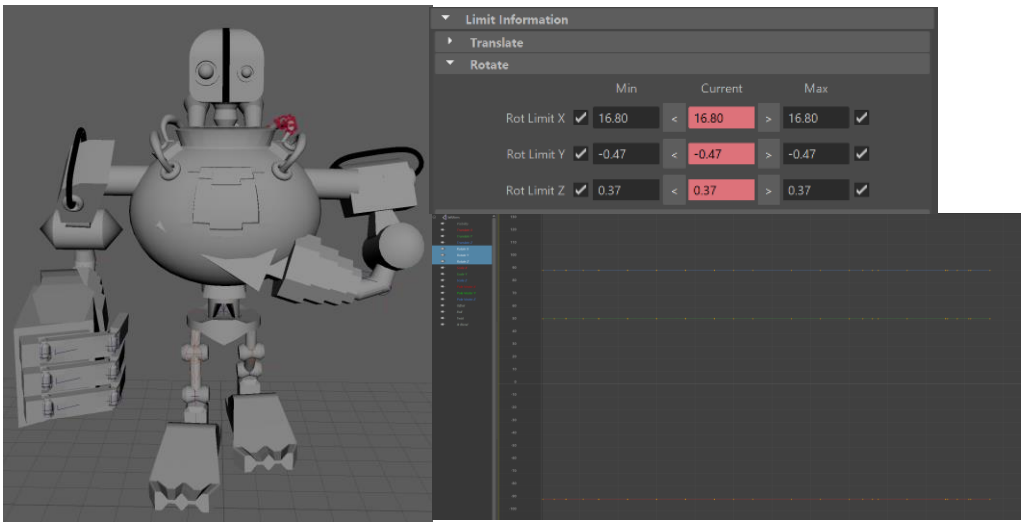


Image14: Arm's IK Handle wrong motion and Solutions

If only the root joint's keyframes were set for the grab animation, the finger joint would not be automatically set keyframes. Therefore, setting their detailed joint keyframes is necessary when trying to transform parts of body.

After setting the finger joint's keyframe for the grab animation, the finger motion will start to predict from the first keyframe. Therefore, it is necessary to set a keyframe before the snatch motion so that the finger motion will predict to start motion late.

The Barbell needs to **translate** with fingers when setting the clean and jerk animation. Therefore, the Barbell could be set constrain with fingers. When the Barbell was set *Point Constrain* with fingers, it needed to set a keyframe and *Blend Point 1* to 0 at the start of the clean and jerk animation. Otherwise, the Barbell will always translate with fingers.

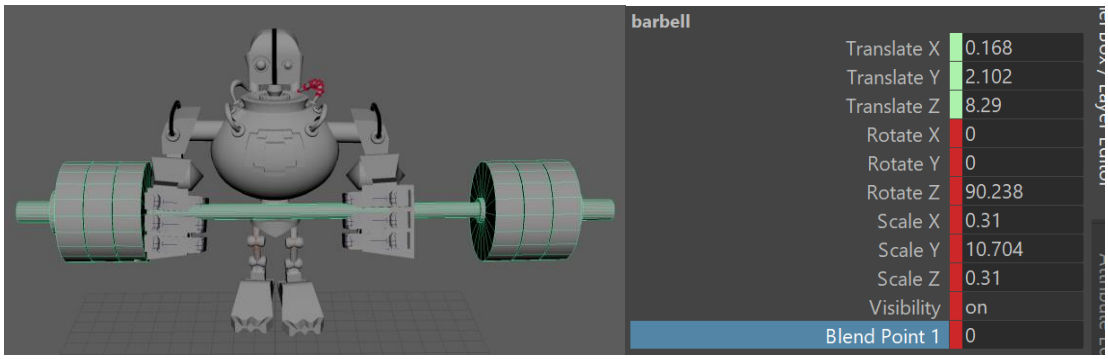


Image14: The potential issue of Constrain and Solution

Make sure to click maintain offset of the constrain part so that the Barbell will move correctly. After that, set a keyframe after one frame clean and jerk animation, and set *Blend Point 1* to 1. The clean and jerk animation contained four main motions: Grab the Barbell to the neck and squat slowly; then slowly stand up straight; calm down for a few seconds and immediately grab the Barbell above the Head and squat down; then slowly stand up straight to finish.

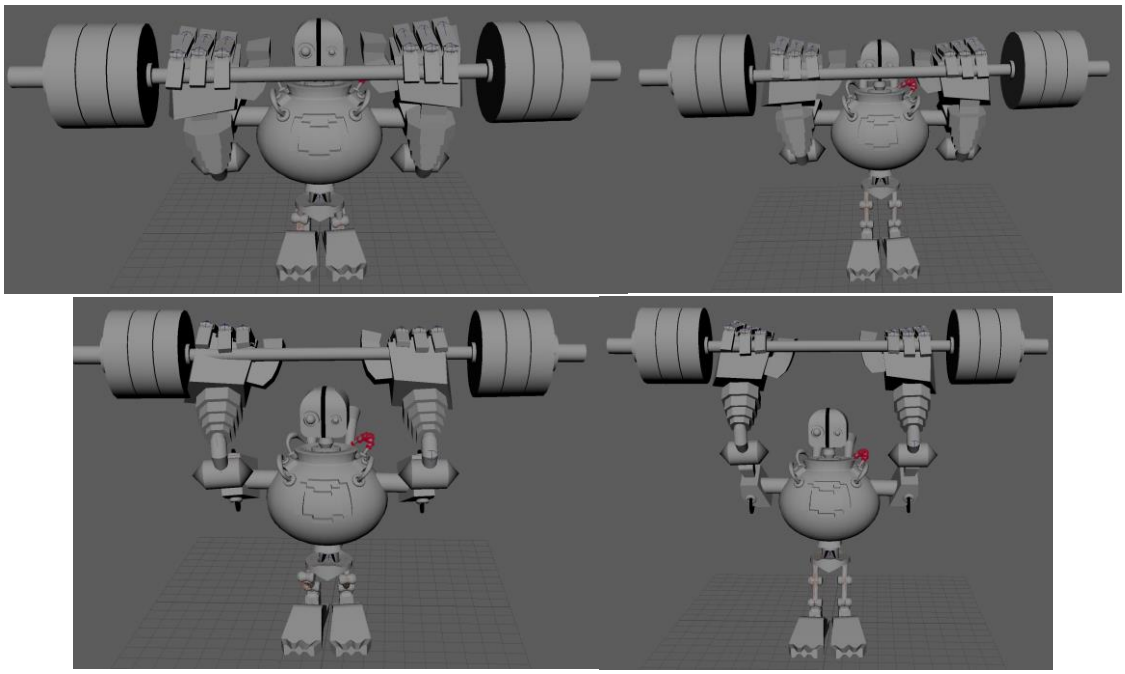


Image15: Four Main Animations

When doing the movement to release the Barbell, it is required to step back the Leg a few steps immediately and then restore the Arm and Hand. The Barbell will bounce a few times when it falls to the ground. At this keyframe, the whole animation is over.

When setting keyframes, there is a possible situation that the distance between some keyframes is so short that the Olympoid transforms very quickly, and the animation is not coordinated. This situation needs to shift parts of keyframes to increase the interval.

One solution is to press **shift** and drag keyframes, but it may cause keyframes to be in the decimal place. These keyframes may not be rendered in Arnold Render because the default rendering setting works for integer frames only.

To improve this situation, **Graph Editor** can be helpful. It has a Region Tool: Scale or Move keys, which can also shift keyframes. Graph Editor is more convenient than the first solution,

and it is easy to move keyframes to the integer place. Because many keyframes had been in the decimal place when working on the first solution, it cost much long time to fix them to be on the integer place using Graph Editor.

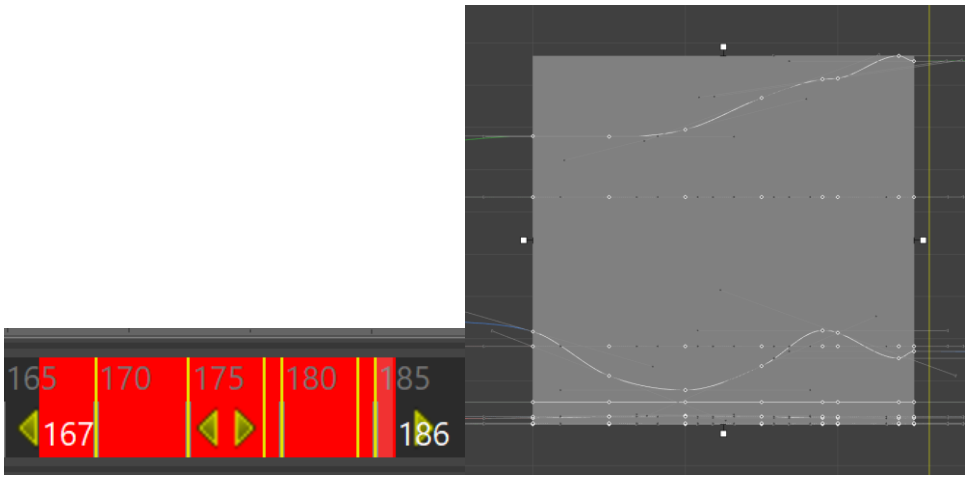


Image16: the solutions to shift keyframes

Camera and Light Design

To observe the entire area of Camera shooting, it is convenient to open the *Resolution Gate* in the Panel so that it can be clear to see which shooting area will be rendered. Camera settings will shoot from multiple positions. There were smooth motion and stepped motion. For example, the first 90 frames set a smooth motion from the front to the left, and the 90th keyframe was directly stepped to the front.

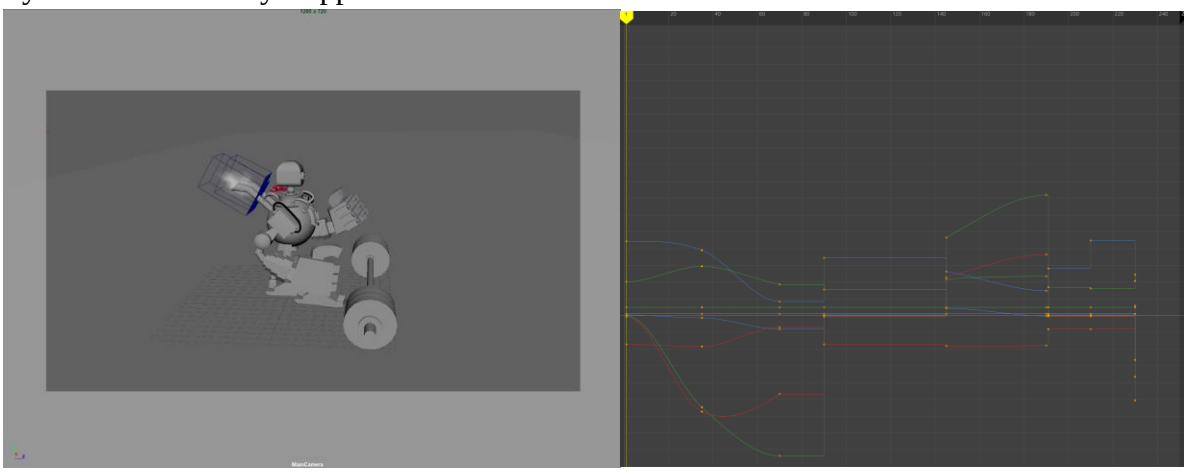


Image17: The Main Camera Motion

When setting the Light, *Skydome Light* was selected. There was a problem when configuring the Skydome Light. When adjusting the scale of the Skydome Light, the images presented in the Panel were not consistent with the images rendered in the Arnold RenderView. It may be because of the error: ***/ MainCamera/MainCameraShape: ignoring scaling component in camera matrix.*** There is no idea how to solve this problem, so choosing a background image without adjusting the scale. The image was downloaded from the Website.

The shadow in the Arnold RenderView is not apparent. Therefore, creating a polygon plane and *Directional Light* so that could see the shadow.

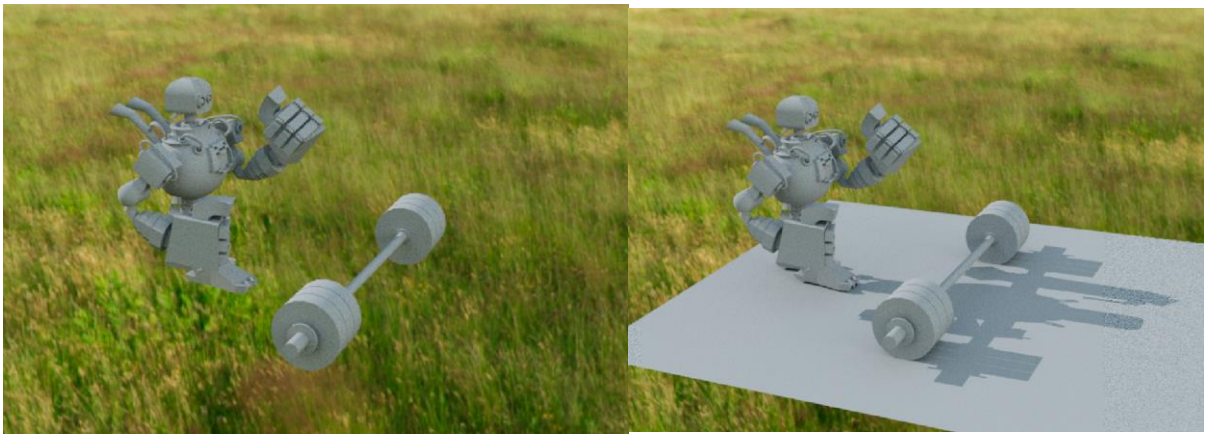


Image18: The apparent Shadow after adding Plane and Directional Light

Rending Design

The Olympoid was designed as a metal robot. Therefore, most of the body was full of *Metalness* and the *Roughness* with 0.289. The Olympoid was set as battle-hardened, so it should look a little rusty.

Head

At first, the narrow Plane and the eye socket on the Head used *Noise* based on the colour. Moreover, the eyes used *U Ramp* without interpolation to make the pupil apparent. The Head used *Noise* firstly. However, the rendering of its surface showed some irregular effects, so it changed into *Brownian*, which also had a tiny speckle.

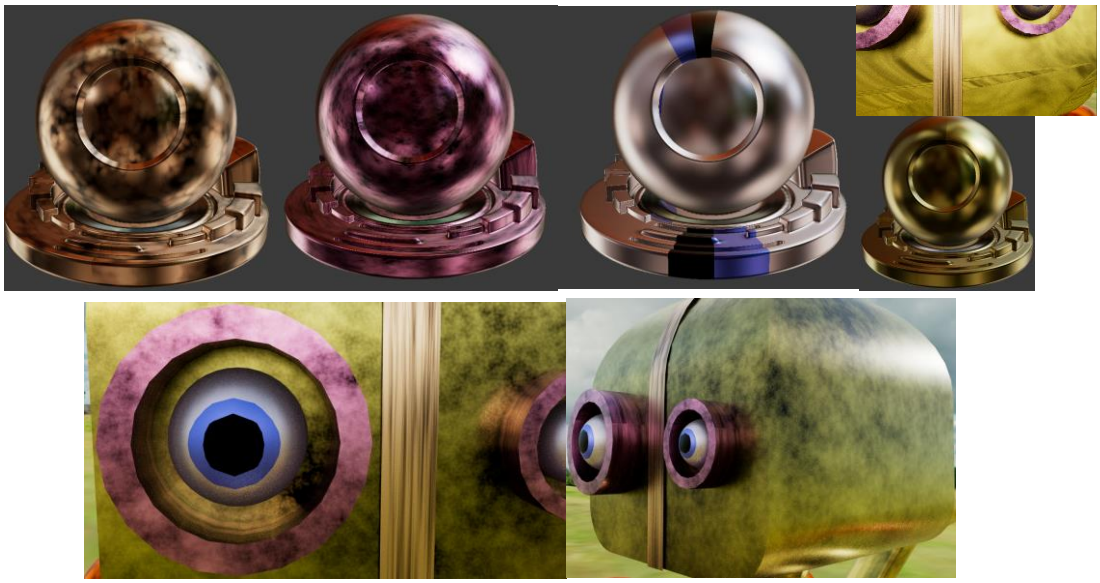


Image19: The narrow Plane, the Eye Socket, Eyes and the Head Materials

Body

Most body parts used the same material, *Noise* and Metal Gold colour. The pipe, torus, some thoracic parts and some joints were also *Noise* but with other colours. The centre of the thorax chose the image of the Olympic rings (downloading from the Website), which used UV editing.

Image20: The Main Body, the Pipe, Torus, Thoracic parts, some Joints and the Centre Thorax Materials

The UV Editor selected the specific faces and opened the UV shell with the Z-axis Planar.

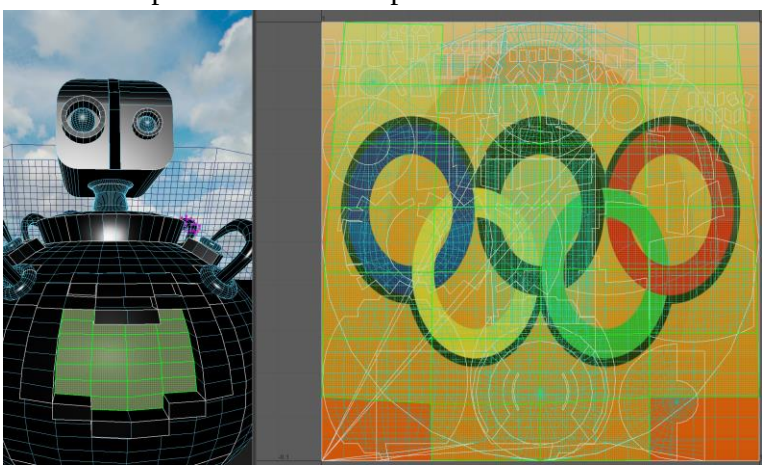


Image21: The UV Shell of Olympic Rings

Barbell

The part to grab Barbell used two surface textures: *Ramp* and *Grid*. It used V Ramp without interpolation first and then chose the specific parts to add Grid with Repeat UV (140,600) to look like a design to increase the friction.

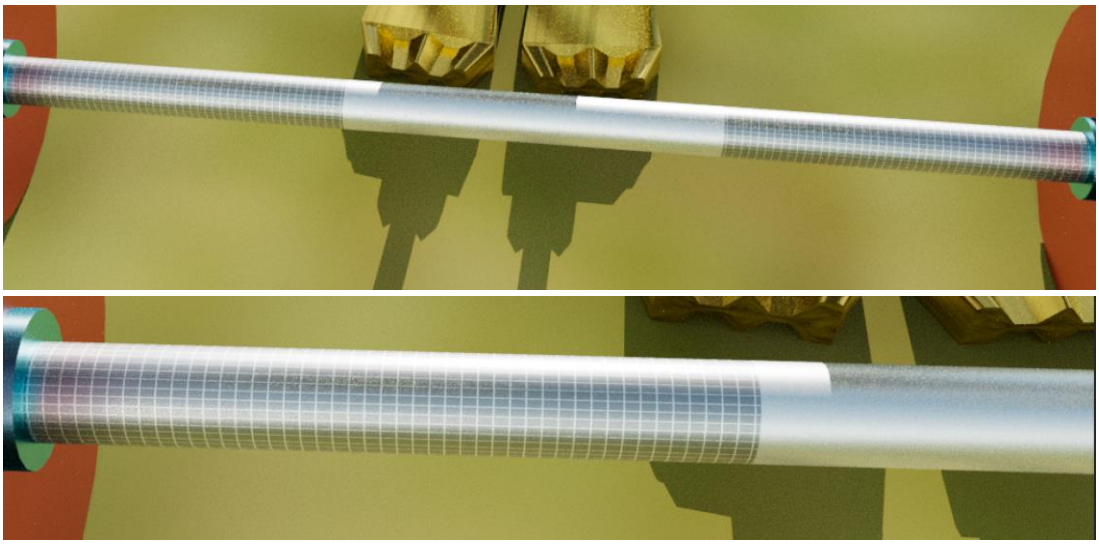


Image22: The Grab Part of the Barbell

Moreover, other parts of the Barbell used common materials with different colours.

Image23: All materials of the Barbell

Ground Plane

To keep the ground Plane and Skydome background in harmony, the Plane was changed the surface material into **AiShadowMatte**, which makes the Plane 100% transparency but can still generate Shadow.

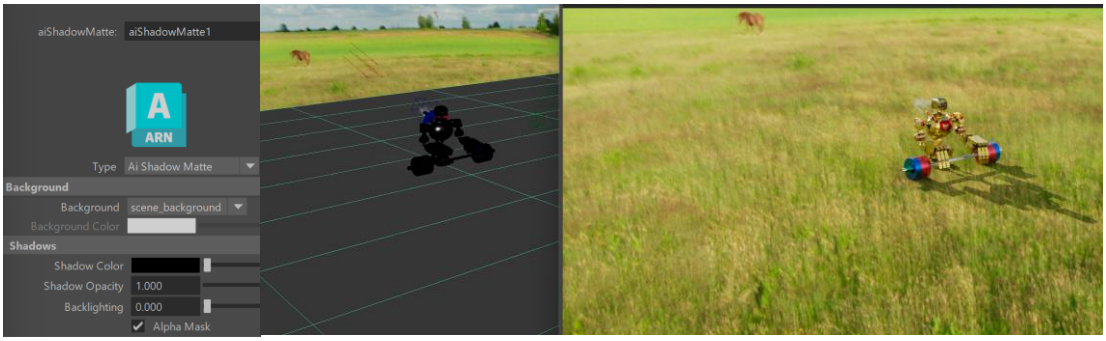


Image24: The Ground Plane using AiShadowMatte

The below images show when all polygons are rendered.

Image25: After Arnold Rendering

The Most Difficult Part of Design

The most challenging part is the Animation Design when setting the Barbell Motion. The *Constrain* is imperfect, and it can not predict all the future transformations. When the Barbell made *point constrain* with one Hand/Fingers and started lifting, the Barbell usually translated at the wrong position and did not fit with the Hand/Fingers. Therefore, it is necessary to check every frame of the Barbell movement and fix the wrong position by setting the keyframe and setting *Blend Point 1* to 0. It was a massive amount of work and the most time-consuming.

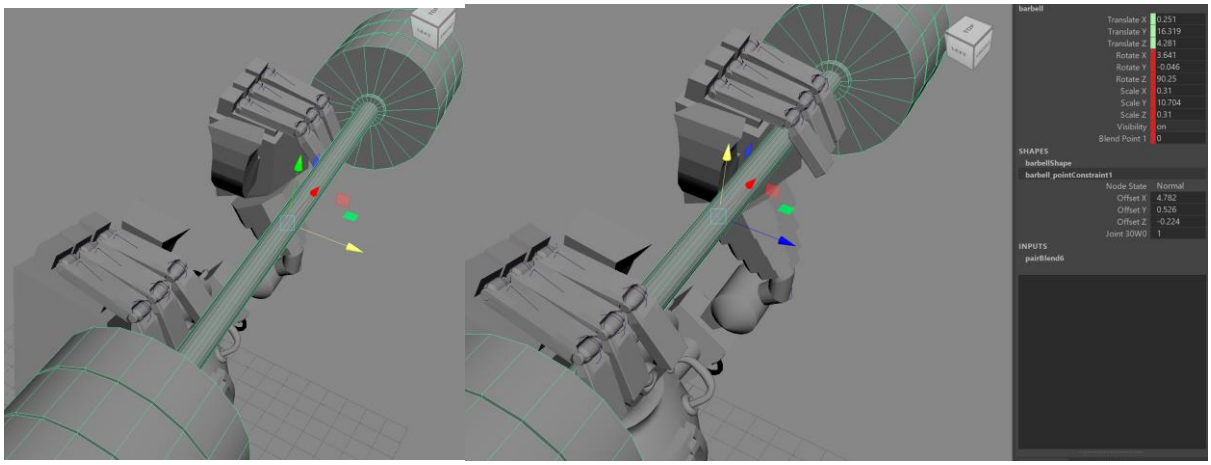
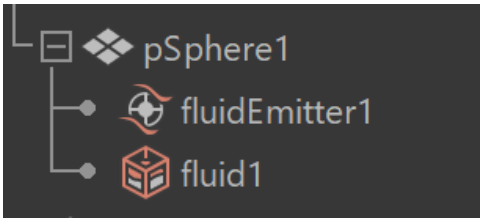


Image26: Before and After Setting Keyframe

The Proudest of Design

The Proudest Design is that some techniques are not taught in class but are learned from the Website. It is a good experience that how to add fluids to make modelling more lively.

In order to visually reflect the Olympoid energy release, some smoke effects were added. Create a Fluid *3Dcontainer*, create a mini Polygon, select both and select *Emit from Object*. A smoky fluid is then produced. After setting them to parent with the Olympoid air cylinder, the smoke will move with the Olympoid. To reflect more energy release while lifting, set *Density/Voxel/Sec* in the *Fluid Attributes*, increase its value when lifting the Barbell and set keyframes. Set the Dissipation in Density Setting to 0 when the control is released, adjust the Dissipation in Density Setting to the maximum value, and set keyframes.



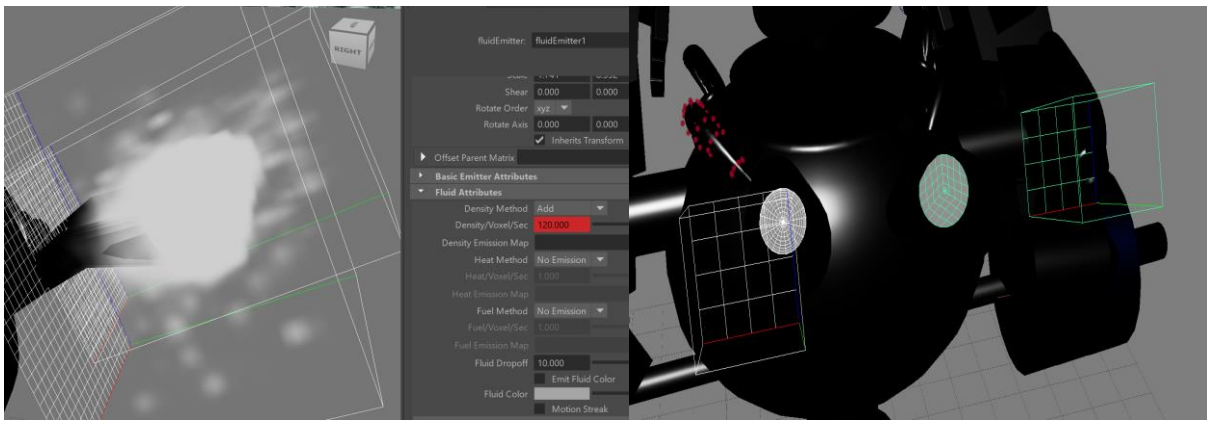


Image27: The Fluids Setting

Conclusion: How to do it differently if doing this work again?

This project is an unforgettable experience, and when the Olympoid is completed, there will be a great sense of accomplishment. Nevertheless, many techniques mentioned in the class are not used. If doing it again, the Head will be modelled in more detail, making it look more human. And will try to add IK Handle to the fingers to make the movement more natural. In addition, find out more tips for solving hand movements at The Barbell and add more complex textures. Hope to continue using Maya in the future.

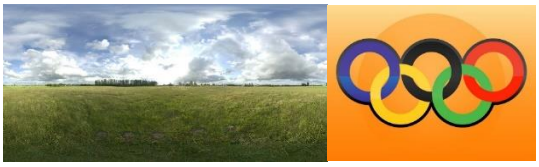
Reference

External Tutorial:

Fluids Design:

"Maya 浓烟制作教程（一）创建流体浓烟_火星时代教程网". *Jiaocheng.Hxsd.Com*, 2022, https://jiaocheng.hxsd.com/course/content/11294/.

Downloading Images:



Skydome Background:

"【外景 HDR 贴图库】_HDR 外景 HDR 贴图下载_ID64150_免费贴图库 - 青模网贴图库". *Tt.Qingmo.Com*, 2022, https://tt.qingmo.com/64150.html.

Olympic Rings:

"奥林匹克标志矢量 - Nicepsd 优质设计素材下载站". *Nicepsd.Com*, 2022, https://www.nicepsd.com/vector/196158/.