Escola Universitària
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DE CATALUNYA

Graduat en Mitjans Audiovisuals

TXIKIA

Report

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Thanks

Thanks to everyone who supported me.

Resum

L'objectiu d'aquest projecte es crear un curt d'animació profesional amb la finalitat d'aprendre i millorar en els procesos de relització d'un curtmetratge: el modelatje, la creació del Set up, la texturització, la iluminació y l'animació. I aconseguir que els personatges tinguin fluïdesa de moviments y una bona expresivitat, ja que això fa que la história sigui creible.

Resumen

El objetivo de este proyecto es crear un corto de animación profesional con la finalidad de aprender y mejorar en los procesos de la realización del cortometraje: el modelaje, la creación del Set up, la texturización, la iluminación y la animación. Y conseguir que los personajes tengan fluidez de movimientos y buena expresividad, ya que es lo que hace que la historia sea creible.

Abstract

The objective of this project is to create a professional animated short, in order to learn and improve the processes of the short film: modeling, creating the Set up, texturing, lighting and animating. And also, get a fluidity of movements and very expressive characters, as it is what makes believable the story.

Index.

Figures index.

Tables index.

Glossary of terms.

CC	Controller
FT	Freeze transformation
GRP	Group
His	History
Hshd	Hypershade
IK	Inverse kinematic
J	Joint
LB	Left button
LYR	Layer
RF	Reverse foot

1. Objectives.

1.1. Purpose.

The purpose is to learn how to use the applications of 3D in every step needed to do a short. At first, a short film animation needs the modelling of the characters and the background, after that, we have to apply the textures and the bones to finally do the rigging of the body and the facial rigging in order to animate the character. Therefore, my purpose is to improve on every branch of animation.

1.2. Finality.

The finality of this project is to create a professional animated short, in order to learn and improve the processes of the short film

1.3. Object.

Txikia consists in an animation short film made in 3D animation with duration of 4:34 minutes.

1.4. Abast.

On the one hand, I want to present my animated short to some aniamtion festivals. On the other hand, this short will help me at the time to submit my resume to companies.

2. Preproduction.

2.1. Research.

One of the first things that are done when starting a project is a research for ideas, references, styles and techniques. The research helps to improve the main idea complementing it and making it stronger. Without a guide, it is easy to get off the way or the style that is wanted to achieve, so it is important to keep in mind the references, both technical and artistic, that initially had been determined, because that will be a help throughout the process of creation and production.

I have divided my research into two. On the one hand, I have made a research of cinematographic references that has helped me in creating a style of short, an aesthetic, and a type of characters, textures and rigging. On the other hand, I have made a search of animation techniques, methods and technology. That is because is the first time that I do all the process of creating a 3D animated short.

2.1.1. Film references.

When I exactly knew how my main idea should be, I reviewed all the films that could be interesting for me. I analyzed it carefully to take the important aspects like the aspect of the characters, the modelling, their movements, the scenes and the script. I took the following movies as reference: *Monsters, Inc. (2001), Madagascar (2005) and Shrek (2001)*. Although, it is known that creating a movie, counting with the help of a big budget and a good team of professionals, is not the same as creating a short film in which one person has to make the script, design, modelling, rigging, sound and editing. So I looked for some references of animated shorts. I found some interesting shorts films like *For the birds (Pixar, 2000)* and *Jack Jack Attack (Pixar, 2005), Sheep In The Island (RG Studios, 2011), Ormie the Pig (Arc Productions Ltd.. 2009), Carrot Crazy (by Dylan Vanwormer and Logan Scelina, 2011), Pigeons (by Sandra Püttner, Franziska Miller, Johannes Englert and Phil Röger, 2010), Love recipe (by Felipe Pizarro S., Frédéric Bajou, Morgan Bourdon, Jiun Yiing Mow and Loïc Paoli, 2008)* and *Oktapodi (by students of Gobelins, 2007)*.

2.1.2. Animation techniques.

My knowledge of Autodesk Maya was not enough to make a short film, so I had to do a research and gather all possible information about the creation of a short animation: what steps to follow, the modelling of characters, the setup, and other things to consider such as rigging, as it is very complex.

On the one hand I found several interesting books which talk about the theoretical part of the animation process. Some of them are *The Animator's Survival Kit* (Richard Williams, 2001) and *The Illusion of Life, Disney Animation* (Frank Thomas and Ollie Johnson, 1981). Both books talk mostly about how things move or how they should move to be credible, and what working methods are used to do it. Both books talk about the 12 principles of animation, that helps us make our creations more credible, and improve the communication, expression and storytelling of our animation, increasing its value and enjoyment of it (see Annex I for more information).

On the other hand I also watched some tutorials which could have helped me in the technique part of the short film, but I thought I was using too many hours with little profit. So I decided to assist in a Maya animation course at 9zeros, Initiation to Autodesk Maya. In this course I improved my knowledge in modelling, texturing and rigging, and the most important, I learned how to do the setup.

2.2. Synopsis.

The short film is about a young monster named Txikia, who is in love with his neighbour Tara. They were dating a year before, but she left him because she met Gogor, a stronger and taller monster than Txikia. He can not forget her and still keeps trying to get her back giving her presents she will like. Tara takes advantage of this situation and does not say no to any present Txikia gives her, as she likes his money and his goodness.

2.3. Characters.

One of my aims was to create a new breed of characters, so I could add some features that can make them more distinctive and at the same time having more expressions.

The characters that I created are characterized by having a colourful skin, antennas, fangs and a big snout. Their colour and hue of the skin vary according to sex and age, in this way, males are bluish or greenish and females are pinkish. The antennas, which move according to their mood, are placed on both sides of the head at eye level. These are long and rounded, and wider at the end. The fangs protrude from the upper lip to the height of the chin, and their thickness varies according to the age. They also have a big snout from which departs two whiskers that extends backwards, surpassing the limit of the head.

2.3.1. Txikia.

Description.

As I explained in the general section, the characteristics of the characters vary according to sex and age. Txikia is the youngest of the three, and because of that, his skin color is light green and his fangs are thinner than Gogor's, Tara's boyfriend.

Txikia is a short and slim guy. His head is proportionally larger than his body. His eyes contrast with his skin tone because they are big and blue, which makes him more expressive and, overall, cute and friendly.

Txikia is a cheerful, friendly and hardworking guy. He always cares about the people around him and treats them with kindness, generosity and education. He is very passionate and is always confident, sometimes too much that he becomes a naive.

Relationships.

Txikia had a very nice relationship with his neighbour Tara one year ago, but one day she broke up with him because she met a taller, stronger and more handsome guy than Txikia. Since then, Txikia has not stopped thinking about Tara and is unable to forget her, so he never stops trying to conquer her. Tara is his weakness, he would leave everything to be with her. The love he feels makes him blind and at the same time, a naive.

Sketch.

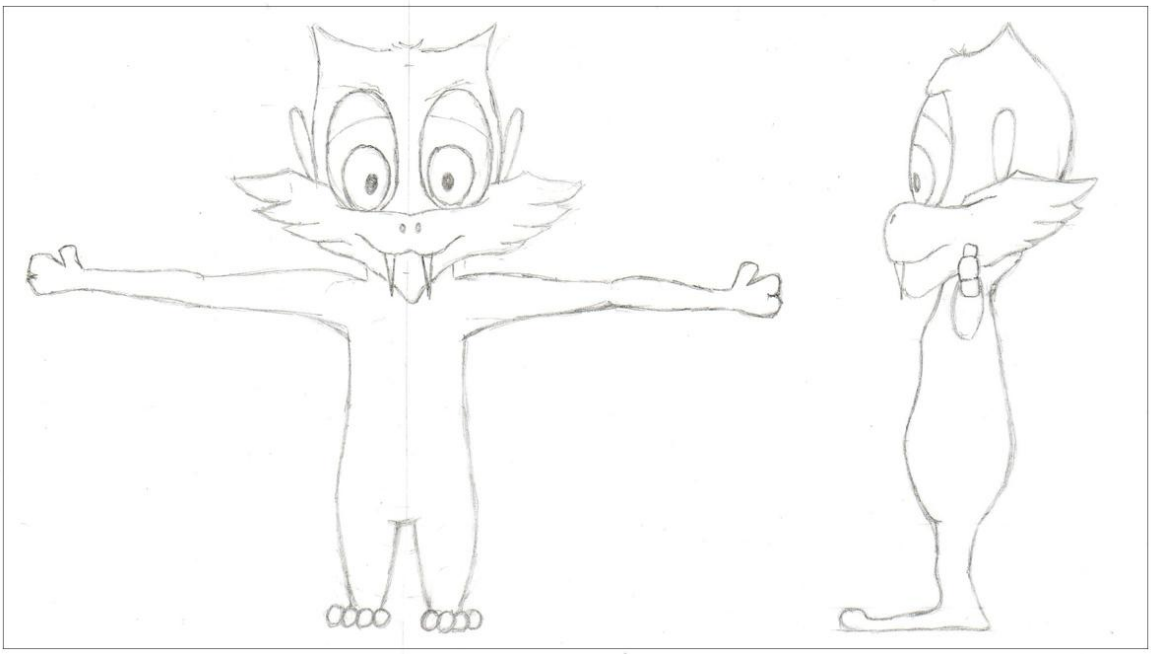


Fig. 2. 1. The first sketch of Txikia.

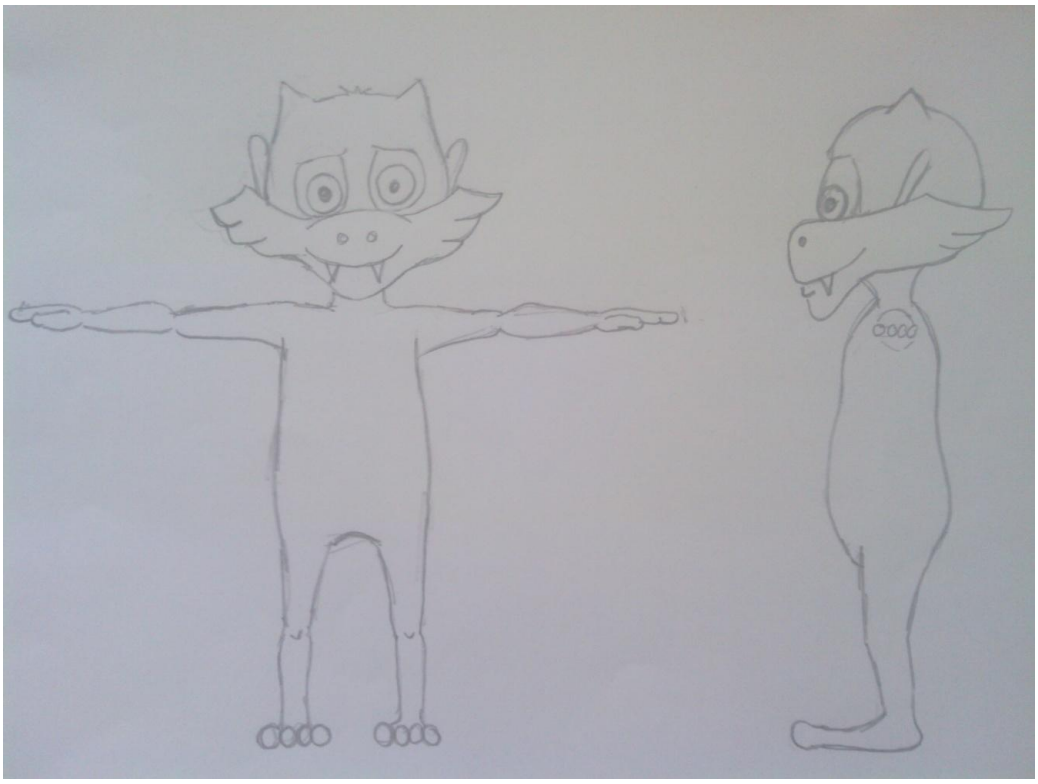


Fig. 2. 2. Final sketch of Txikia.

Character Views.

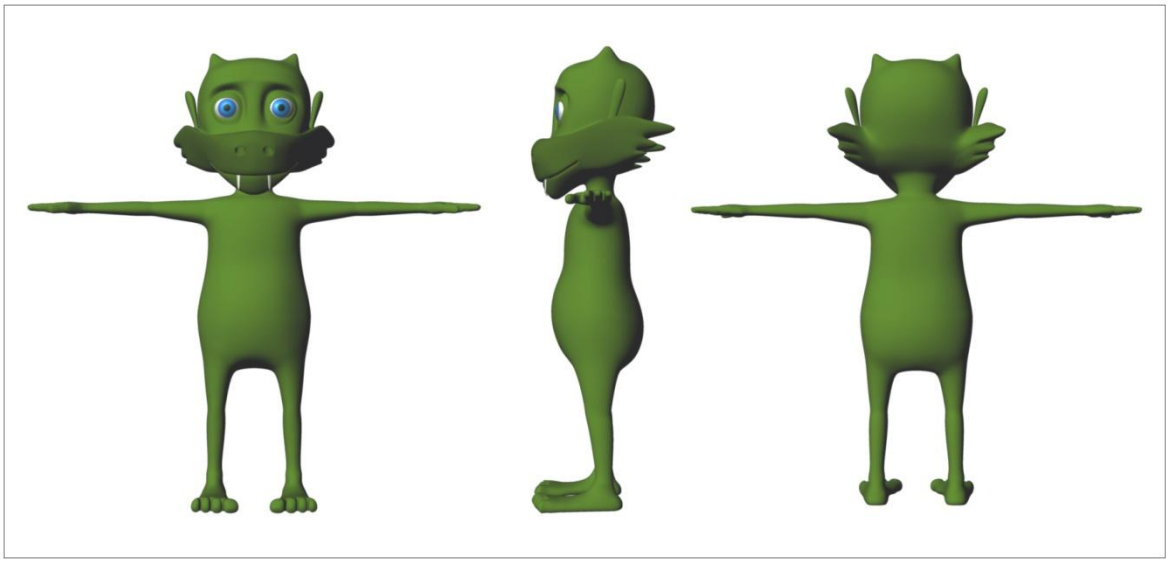


Fig. 2. 3. Txikia 3D views: front, side and back.

2.3.2. Tara.

Description.

Tara is a young montser with pinkish skin, and for the fact of being a woman she does not have fangs. She is tall and svelte. She is a pretty thin girl, with wasp waist and pert bum. Her eyes also contrast with her skin tone as they are light green.

Tara is impudent and vain, and she likes to brag. She has a shallow character, and she is only interested in expensive and beautiful things, and in handsome, tall and strong men. She is very selfish and egocentric and not able to see beyond her interests, she just thinks of herself without worrying about the other people's feelings. She is an interested person, she can make you feel like a king one day and it is better not to cross with her the next day. Tara is bad tempered, liar, malicious and insolent.

Relationships.

Tara was Txikia's girlfriend. They loved each other a lot at the beginning but then she became egocentric and superficial. One day she met a monster named Gogor, he was taller and stronger than Txikia, so she broke up with her boyfriend to be with Gogor.

Sketch.

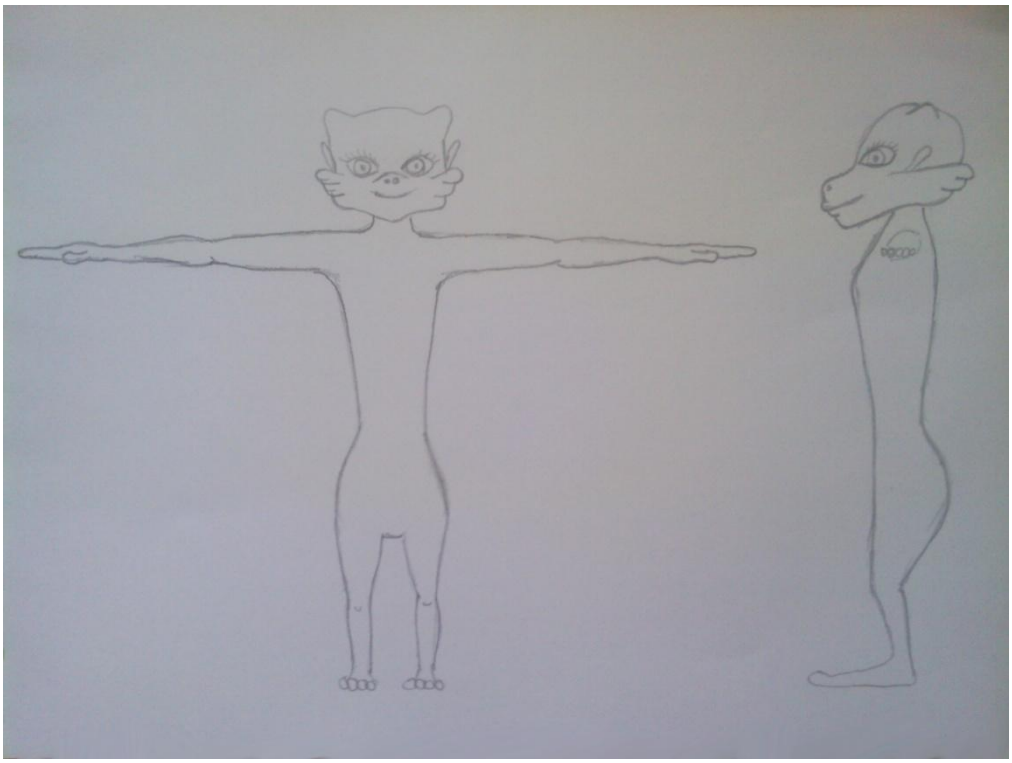


Fig. 2. 4. Tara's sketch.

Character Views.

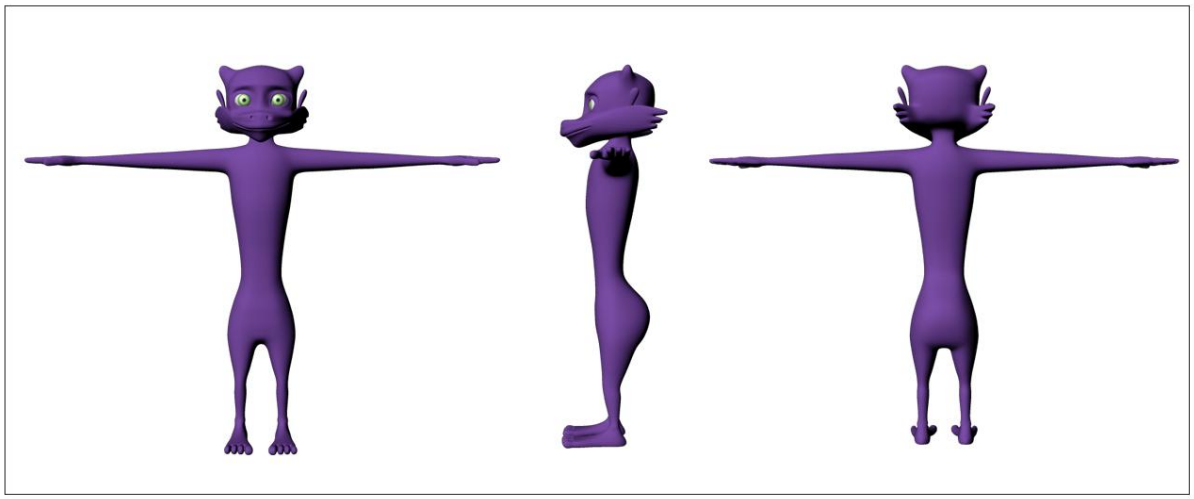


Fig. 2. 5. Tara 3D views: front, side and back.

2.3.3. Gogor.

Description.

Gogor is the largest of the three. He is characterized by having a bluish skin tone and fangs thicker than Txikia's. He is tall and strong, a boy from gym, very muscular, with big arms and short and thin legs. His eyes are brown honey.

Gogor, despite being a pimp boy of the gym, is honest, very quiet and sincere guy in the background, but he can be a grump sometimes.

Relationships.

Gogor is Tara's boyfriend. They will celebrate a year together since she broke up with Txikia.

Sketch.

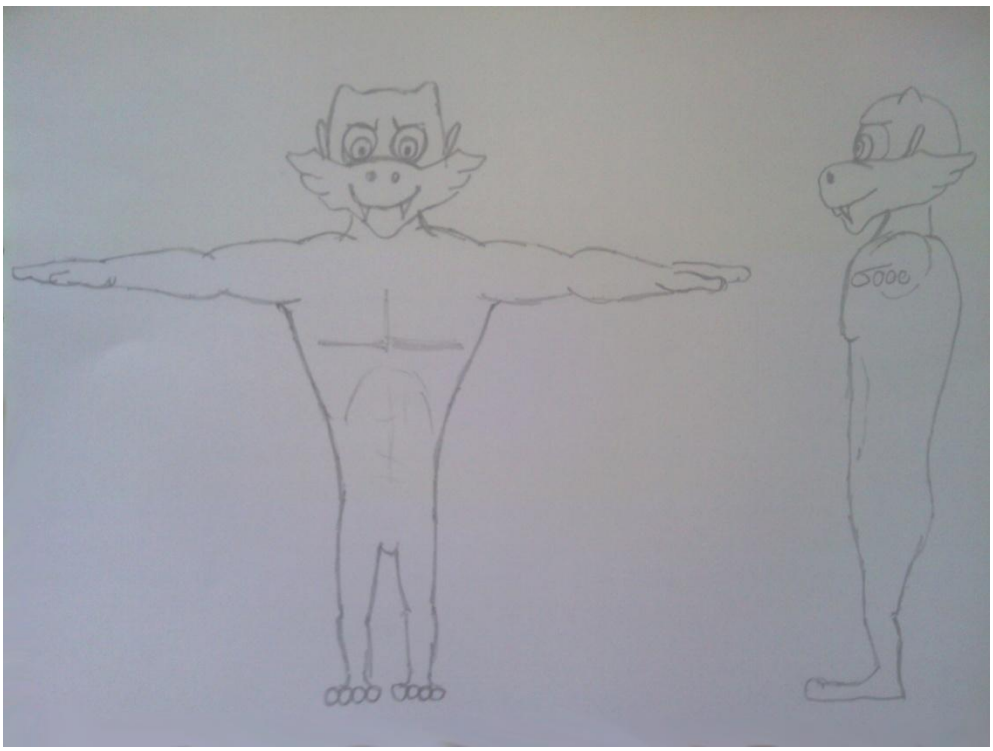


Fig. 2. 6. Gogor's sketch.

Character Views.

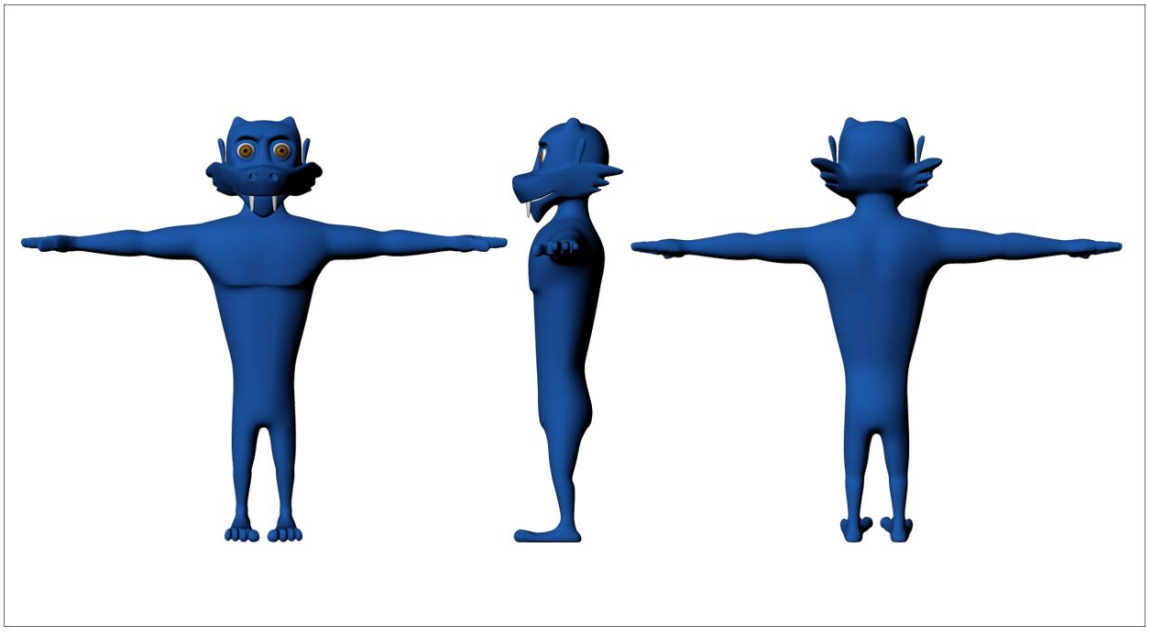


Fig. 2. 7. Gogor 3D views: front, side and back.

2.4. Script.

A little boy named Txikia lives in a small town surrounded by mountains. He is cheerful, charming and friendly. He is in love with his neighbour Tara, whom he used to date, but she broke up a year ago, so he will try to win her back.

Txikia is in his garden planting some mushrooms and stops to look at Tara. She, naughty, greets at him, and he, who cannot stop thinking about her, greets back at her excited.

Txikia is in the bathroom looking at the mirror. He starts posing; in a first place he does a pimp flirty face, he lifts his hand in a gun-shaped form using his thumb and forefinger and he points forward. He smiles at the mirror, as if he was a girl, and then, simultaneously, he winks and bends his thumb where he has the "gun". After that he relaxes and changes his pose. He puts a face of an interesting guy while his arms are crossing. He looks down and raises his eyebrows. He turns the body slightly to his right, keeping his eyes to the mirror. He tilts his head to the side, raises his right thumb closer to his mouth and then rubs his lips with it, like if he was the Martini guy. After staying a few seconds staring at the mirror, Txikia looks up to see eye to eye. Then his position vanishes: his arms flops, his head falls while his eyes close and, finally, his legs bends as if the force that keeps him standing has

been over. Seconds later he looks at the mirror like if he was going to find there the solution to recaptivate his neighbour's heart. And in the end he raises his forefinger in order to show he has a good idea. Then he diverts the view slowly to the side and looks at a bouquet of flowers for a while.

Txikia leaves home happily holding a mushroom in a pot and he goes to Tara's house. He arrives at the entrance door and knocks with his knuckles. The door opens and she comes out with a do-not-bother-me face. He smiles and extends his arm to give her the mushroom. She smiles while she picks it and takes out a shovel for Txikia, making him do some gardening work.

Txikia breathes deeply and looks at his neighbour after working for a long time. She looks at him while she holds a San Francisco cocktail in one hand, and she fans with the other.

In the evening Txikia is at home thinking about her and looking at a picture of Tara and him while they were together.

On the next day Txikia decides to go to Tara's house to see her again. She opens the door with a scowl and Txikia smiles at her, but she is only interested in material things, so she extends her arm in order to say "give me some presents". Txikia shrugs and spreads his hands saying he has nothing to give her. Tara realizes that he has not brought anything and slams the door in his nose.

Txikia, despite having gone wrong the last time he went at her house, decides to try to conquer her again, but this time he brings a gorgeous necklace. Tara is very surprised and claps her hands with joy. She puts the necklace on and looks it excitedly. Txikia closes his eyes and leans to her looking for a kiss. She looks at him and gives him a kiss on the forehead. He smiles keeping his eyes closed, but she closes the door right after the kiss.

Txikia, in desperation, comes back to Tara's house, but this time he decides to speak clear and tell her all his feelings, so he buys a box of chocolates and puts a note on it saying "I love you". While he is going to her house, Gogor, a handsome guy with a motorbike, stops in front Tara's house and greets. He is her boyfriend. As Tara walks toward Gogor, Txikia approaches her with a box of chocolates. She looks at him with disgust and pushes him away. Txikia falls down upset and gets annoyed. Gogor is surprised and angry, and he

realizes that his girlfriend is not the kind of person he wants to be with, so he breaks the relationship up.

Txikia goes back home sad. Minutes later, he listens somebody knocking on the door. When he opens it, he sees Tara staring at him with a huge smile meaning to say “forgive me”, and trying to get a date with him. Txikia smiles thinking “this is my chance”, and slams the door at Tara’s nose.

2.5. Storyboard.

The storyboard of my animation short, "Txikia", was made with *Toom Boom*, following the requirements of Glyndwr University. Having a storyboard is usefull at the time to animate and place the cameras on the scene, as this document marks the duration of the actions.

I did a Story Board in Wales, but then during the summer I changed some shots, for that reason, the new and final document has mark water. I do not have the license of the program and Tecnocampus either.

TXIKIA STORYBOARD Part 1

Scene	Duration	Panel	Duration
2	10:00	1	10:00

Notes

Big Long Shot and Zoom In, Txikia's City.

Scene	Duration	Panel	Duration
3	07:00	1	07:00

Action Notes

Txikia is planting a mushroom in his garden, stops for a moment to rest, and turns his head to look at his neighbor.

Notes

American Shot

Scene	Duration	Panel	Duration
4	05:00	1	05:00

Action Notes

The neighbor smiles and greets.

Notes

Medium Shot.

TXIKIA STORYBOARD Part 1

Scene	Duration	Panel	Duration
5	05:00	1	05:00

Action Notes

Txikia smiles and greets as well.

Notes

American Shot.

Scene	Duration	Panel	Duration
6	15:00	1	15:00

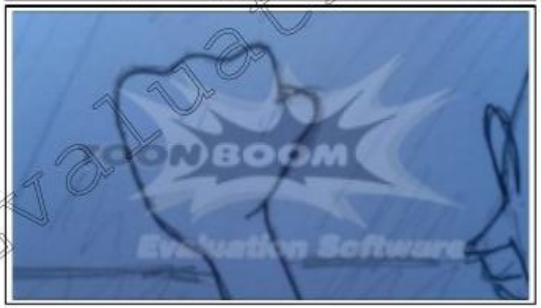
Action Notes

Txikia is gesturing in front of the mirror like he was flirting with him.

Notes

Medium Shot.

Scene	Duration	Panel	Duration
8	02:00	1	02:00



Action Notes

Txikia knocks on the neighbor's door.

Notes

Close Shot.

TXIKIA STORYBOARD Part 1

Scene	Duration	Panel	Duration
9	07:00	1	07:00

Action Notes

The door opens and Txikia gives her a mushroom.

Notes

Medium Shot.

Scene	Duration	Panel	Duration
10	07:00	1	07:00

Action Notes

She smiles, takes the mushroom and gives him a shovel to work in her garden.

Notes

Medium Shot.

Scene	Duration	Panel	Duration
11	08:00	1	08:00

Action Notes

Txikia, after much work, takes off his sweat and smiles at her neighbor.

Notes

American Shot.

TXIKIA STORYBOARD Part 1

Scene	Duration	Panel	Duration
12	05:00	1	05:00

Action Notes

She smiles and makes an OK with her hand.

Notes

Medium Shot.

Scene	Duration	Panel	Duration
13	10:00	1	10:00

Action Notes

Txikia is at home looking at a picture of when he was dating his neighbor.

Notes

Close Shot.

Scene	Duration	Panel	Duration
14	02:00	1	02:00

Action Notes

Txikia knocks on the neighbor's door.

Notes

Close Shot.

TXIKIA STORYBOARD Part 1

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Scene	Duration	Panel	Duration
15	05:00	1	05:00

Action Notes

The door opens and Txikia greets.

Notes

Medium Shot.

Scene	Duration	Panel	Duration
16	05:00	1	05:00

Action Notes

She half heartedly smiles and extends his hand like saying to Txikia to bring her a gift.

Notes

Medium Shot.

Scene	Duration	Panel	Duration
17	05:00	1	05:00

Action Notes

Txikia shrugs and spreads his hands as if to say that he has nothing to give her.

Notes

Medium Shot. Deep to Black,

TXIKIA STORYBOARD Part 1

Scene	Duration	Panel	Duration
18	02:00	1	02:00

Action Notes

Txikia knocks on the neighbor's door.

Notes

Close Shot.

Scene	Duration	Panel	Duration
19	08:00	1	08:00

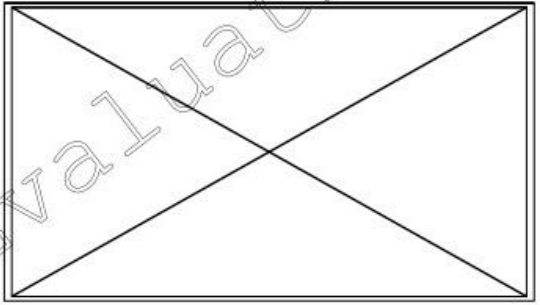
Action Notes

(Txikia this time returns home from his neighbor with a gift.) Txikia smiles holding an open box with a necklace.

Notes

Close Panoramic Shot.

NO PANEL



STORYBOARD TXIKIA Part 2

Page 1/6

Scene	Duration	Panel	Duration
2	05:00	1	05:00

Action Notes

She, surprised, clasps her hands with joy.

Notes

Close Shot.

Scene	Duration	Panel	Duration
3	03:00	1	03:00

Action Notes

Txikia is happy to see her like this.

Notes

Close Shot.

Scene	Duration	Panel	Duration
4	05:00	1	05:00

Action Notes

She puts the necklace and looks excited.

Notes

Close Shot.

STORYBOARD TXIKIA Part 2

Scene	Duration	Panel	Duration
5	07:00	1	07:00

Action Notes

Txikia closes his eyes and he leans to his neighbor gives him a kiss.

Notes

Medium Shot.

Scene	Duration	Panel	Duration
6	07:00	1	07:00

Action Notes

She gives him a kiss on the forehead. He, still with closed eyes, smiles.

Notes

Close Shot. Deep to Black.

Scene	Duration	Panel	Duration
7	05:00	1	05:00

Action Notes

Comes the neighbor's boyfriend on a motorcycle, and greets his girlfriend.

Notes

American Shot.

STORYBOARD TXIKIA Part 2

Page 3/6

Scene	Duration	Panel	Duration
8	03:00	1	03:00

Action Notes

She greets.

Notes

Medium Shot.

Scene	Duration	Panel	Duration
9	03:00	1	03:00

Action Notes

The boyfriend greets.

Notes

Close Shot.

Scene	Duration	Panel	Duration
10	07:00	1	07:00

Action Notes

As she walks toward her boyfriend, Txikia approaches her with a box of chocolates.

Notes

American Shot.

STORYBOARD TXIKIA Part 2

Scene	Duration	Panel	Duration
11	04:00	1	04:00

Action Notes

Txikia smiles showing her the box of chocolates with a note that says "I love you".

Notes

Medium Shot.

Scene	Duration	Panel	Duration
12	06:00	1	06:00

Action Notes

She looks at him with disgust and pushes him. Txikia falls.

Notes

Medium Shot.

Scene	Duration	Panel	Duration
13	06:00	1	06:00

Action Notes

The boyfriend is surprised and angry. He shakes his head.

Notes

Close Shot.

STORYBOARD TXIKIA Part 2

Page 5/6

Scene	Duration	Panel	Duration
14	06:00	1	06:00

Action Notes

Txikia, on the ground, is disappointed and sad.

Notes

American Shot.

Scene	Duration	Panel	Duration
15	12:00	1	12:00

Action Notes

The angry boyfriend leaves his girlfriend and goes on the motorbike.

Notes

Medium Shot.

Scene	Duration	Panel	Duration
16	05:00	1	05:00

Action Notes

The neighbour comes to Txikia's house again to try to get a date with him, because her boyfriend has left her.

Notes

Close Shot.

STORYBOARD TXIKIA Part 2

Scene	Duration	Panel	Duration
17	07:00	1	07:00

NO PANEL

NO PANEL

Action Notes

Txikia smiles as saying this is my chance, and slams the door in the nose of her neighbor.

Notes

Close Shot.

2.6. Shooting script.

SHOT	SHOT DESCRIPTION	LOCATION	CHARACTER	ACTION
1	Long shot of the landscape and Zoom In	Landscape	-	-
2	Medium shot of Txikia	Txikia's garden	Txikia	Txikia is planting mushrooms.
3	Long shot	Txikia's garden	Txikia	Txikia stand up.
4	Medium shot of Tara	Tara's garden	Tara	Tara greets.
5	Close shot of Txikia	Txikia's garden	Txikia	Txikia greets.
6	Medium shot of Txikia	Txikia's bathroom	Txikia	Txikia is gesturing.
7	Close shot.	The entrance of Tara's house.	Txikia	Txikia knocks on the door.
8	Medium shot of Txikia	The entrance of Tara's house	Txikia and Tara	Txikia gives her a mushroom.
9	Medium shot of Tara	The entrance of Tara's house	Txikia and Tara	She takes the mushroom and gives him a shovel.
10	Large shot of Txikia	Tara's garden	Txikia	He breathes hard of exhaustion and looks toward Tara.
11	Medium shot of	Tara's	Tara	She, with a cocktail in hand,

	Tara	garden		fans herself.
12	Medium shot of Txikia	Txikia's hall.	Txikia	Txikia looks sad a picture of Tara and him on vacation.
13	Close shot	The entrance of Tara's house	Txikia	Txikia knocks on the door.
14	Close shot of Txikia	The entrance of Tara's house	Txikia	Txikia waits for Tara to open the door.
15	Medium shot of Tara	The entrance of Tara's house	Txikia and Tara	Tara tells him that she wants a gift.
16	Medium shot of Txikia.	The entrance of Tara's house	Txikia	Txikia says that he has nothing to give her. The door closes and Txikia leaves sad the entrance.
17	Close shot	The entrance of Tara's house	Txikia	Txikia knocks on the door.
18	Medium shot of Txikia	The entrance of Tara's house	Txikia and Tara	Txikia shows her the gift.
19	Close shot of Tara	The entrance of Tara's house	Tara	Tara smiles as she wonders what it will be.
20	Close shot of the box.	The entrance of Tara's house	Txikia	Txikia opens the box.
21	Medium shot of	The entrance	Txikia	Txikia is watching her as she

	Txikia	of Tara's house		puts the necklace.
22	Close shot of Tara	The entrance of Tara's house	Tara	Tara is happy with her necklace.
23	Close shot of Txikia.	The entrance of Tara's house	Txikia and Tara	Txikia bows expecting a kiss and she gives him a kiss on the forehead.
24	Medium shot of Gogor	Street	Gogor	Gogor arrives with his motorbike.
25	Close-medium shot	The entrance of Tara's house	Tara	Tara greets happy.
26	Large shot of Gogor	Street	Gogor	Gogor greets.
27	Medium shot of Tara	The entrance of Tara's house	Tara	Tara walks toward Gogor.
28	Medium shot of Txikia	Street	Txikia	Txikia walks toward Tara.
29	Close shot of Tara	Street	Tara and Txikia	Txikia shows her the box of chocolates, and Tara sulks.
30	Close shot of the box of chocolates	Street	Txikia	Txikia moves the chocolate box to one side, and realizes that Tara is angry.
31	Large shot of Txikia and Tara	Street	Txikia and Tara	Tara pushes away Txikia and he falls down.
32	Medium shot of Gogor	Street	Gogor	Gogor sees what she has done and gets angry.

33	Large shot of Txikia	Street	Txikia	Txikia is on the ground in pain.
34	Medium shot of Tara and Gogor	Street	Tara and Gogor	Tara wants to stroke Gogor, but he moves away. He wants nothing else of her and leaves.
35	Medium shot of Tara	The entrance of Txikia's house	Tara	Tara knocks on the door.
36	Medium shot	The entrance of Txikia's house	Txikia and Tara	Txikia opens the door. Tara says sorry.
37	Close-medium shot	The entrance of Txikia's house	Txikia	Txikia says goodbye to her and closes the door.
38	Large shot	Txikia's house	Txikia	Txikia jumps toward the camera and winks.

Table. 1. Shooting script.

3. Modelling.

3.1. Characters.

The three characters are modelled in the same way, so I will explain how I did Txikia's body.

1. The first thing that we have to do is to import the character sketches. We go to *View > Image Plane > Import Image Plane*, we select our image reference and press *Open*.
2. We start with a cube and we do a *Smooth* (*Mesh>Smooth*) to have material to make the limbs. Now we select half of the faces from the front view, and we delete them.
3. We move the vertices to match the abdominal area of the model in all views. We move the vertices with the *Move* tool (W on the keyboard).
4. We select the two top faces and we extrude them to create the torso (*Edit mesh > Extrude*). After that, we add new *Edges loops* to generate the shape of the paunch and chest. (*Edit mesh > Insert edge loop tool*).
5. We use the extrude tool to create the arm and we scale (R) the new generated faces to adapt them to the size of the arm. We add geometry in the mesh areas where the character will bend, at least three *Edge loops*. Add geometry will help us to get better movements in our character. We do the same process to create the leg.

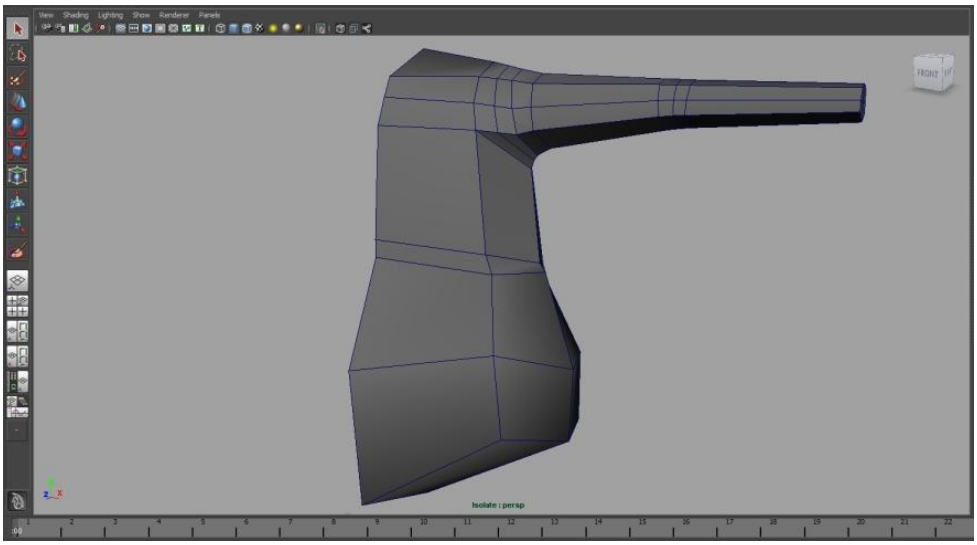


Fig. 3. 1. Txikia: Chest, paunch and arm.

** Each time we add new geometry, we should check that is well placed in all views.*

6. We move the vertices to adjust them to the shape of the character in all views. We extrude the tip faces of the leg to create the foot, and we add geometry to have enough material to shape the foot (See the image bellow).

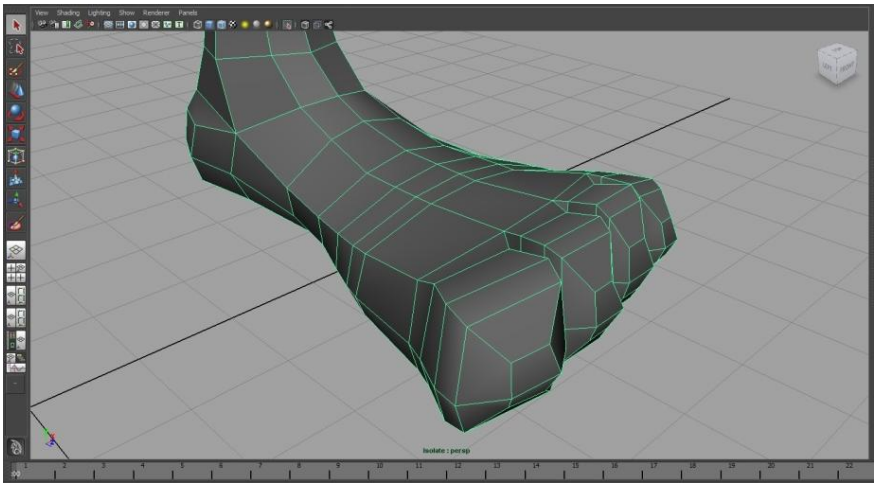


Fig. 3. 2. Txikia's foot.

7. Once we have the torso, arm and leg, we select the mesh and we duplicate it (Cntrl+D). Now we go to the *Channel Box* and we scale the X of the new mesh in -1. Then, we select the mesh and by pressing *Shift* we select the other and, we go to *Mesh* > *Combine*. We have already achieved a single object, now we must paste the parts. We select the centerline of vertices and we go to *Edit Mesh* > *Merge*.

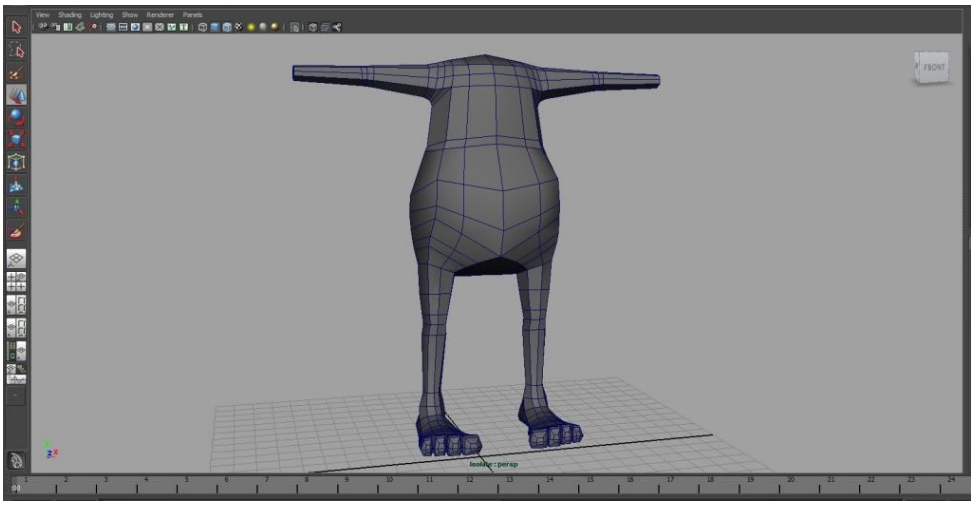


Fig. 3. 3. Txikia's body.

8. After doing the body, we proceed to do the hand. We start creating a cube, we scale to adjust to the hand shape, and we add some subdivisions. Now, we select the faces that correspond to the fingers and we extrude them with the option *Edit Mesh* > *Keep Faces Together* switched off. We add geometry to the fingers.

9. We select the faces of the wrist and we extrude them to create the shape of the wrist. Now we add more geometry to establish the hand shape.

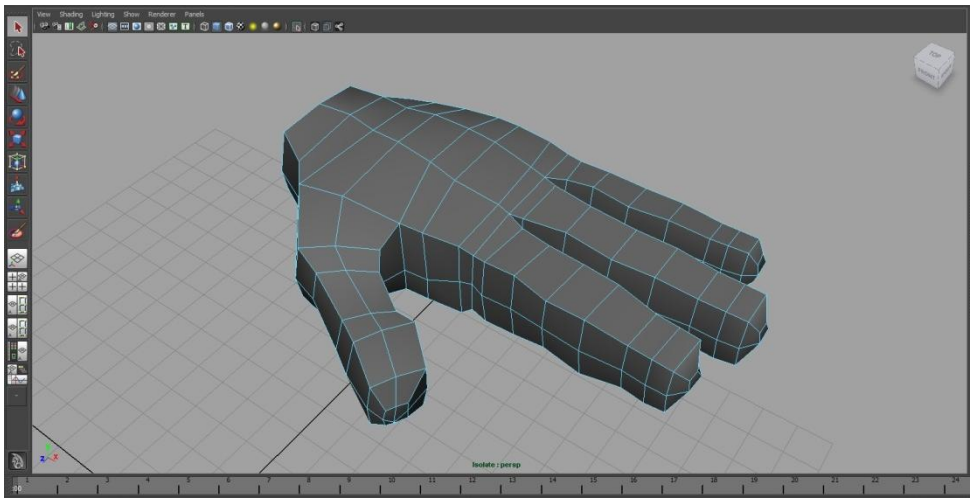


Fig. 3. 4. Txikia's hand.

10. Now we do a *Combine* of the body with the hand and, we select the vertices of the wrist and go to *Edit Mesh* > *Merge*.
11. The last thing that we need to create is the face. We start with a cube and we add a division in horizontal way. We do a Smooth and we delete half of the faces from the front view. Then, we move the vertices to adapt them to the head shape.
12. We add a division to eye level with the tool *Edit Mesh*> *Cut Faces Tool*. We prepare the eye area by drawing the outline of the eye with the *Split Polygon Tool* (in *Edit Mesh*). We add more detail to the eye area, we create a sphere right in the center of the eye and, we create the eyelids by adapting the geometry of the eye to the sphere.

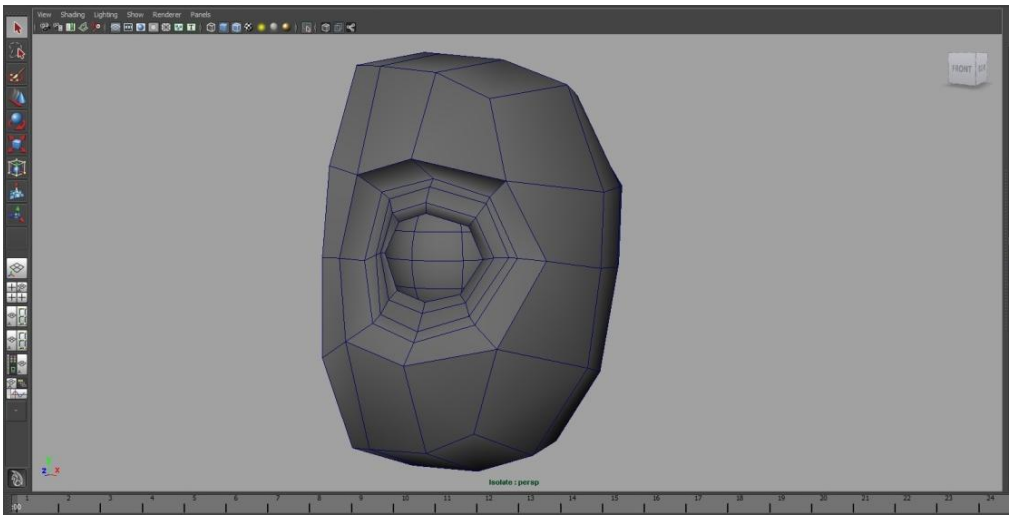


Fig. 3. 5. Txikia's eye.

13. Now we add geometry to prepare the area of the snout and, we extrude the frontal faces. We continue adding *Edge loops* to the snout to have enough material to adapt the shape.

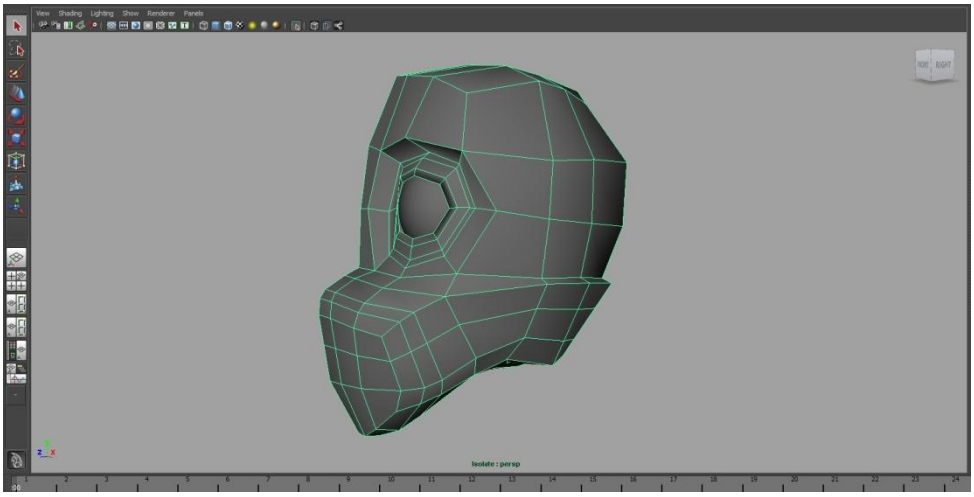


Fig. 3. 6. Txikia's snout.

14. Now is time to make the beards that stand backwards. We select lateral faces and we extrude them out. We add some geometry with the *Split Polygon Tool* and we move the vertices to get the shape of the beard.

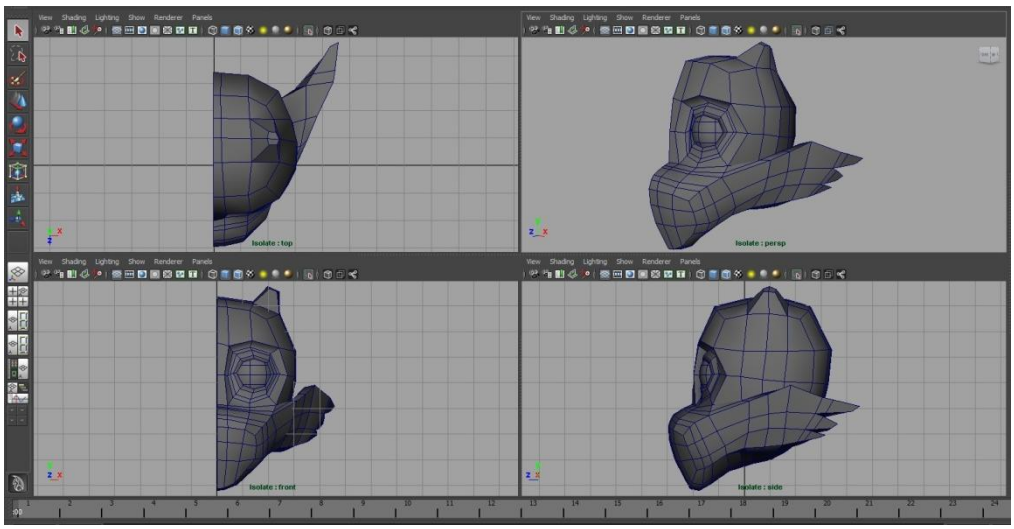


Fig. 3. 7. Txikia's beard.

15. We selected a face behind the beard and we extrude it to create the antenna. Then we add two *Edge Loops* so that we can do the antenna thicker in the center.
16. We selected a face of the snout and we extrude inward to create the nostrils.
17. Now we create the mouth. We draw the outline of the mouth with the *Split Polygon Tool*, and then, we select the faces inside of the outline and we delete them. We

select the edges of the mouth and we go doing extrudes and moving the vertices until we get the mouth cavity.

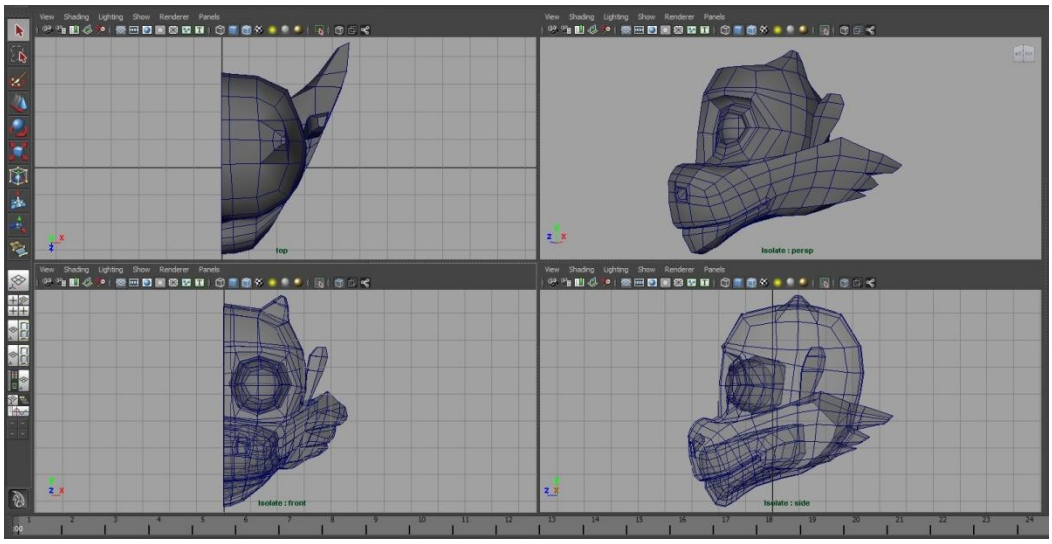


Fig. 3. 8. Txikia's mouth.

* We can see the final shape pressing 3 on the keyboard, is like a *Smooth*. We press 1 to return to the original.

18. We select a face of the palate and we extrude it to do the fang. We add geometry and we scale the vertices of the tip to get a sharp tip.
19. Once we are sure that the half the face is finished, we select the model and duplicate it (Cntrl + D), and we change the scale of the copy on the X axis to -1. We select both models and we do a *Combine*. Now we select vertices of the center and we go to *Edit Mesh > Merge Vertices*.
20. We create the neck by extruding four faces of the bottom of the head. We delete the faces of the bottom of the neck. Now we prepare the geometry of the body for the neck. We delete the four faces of the body where the neck has to be connected. We press V (*Snap Point*) to snap the points, then we select both models and we do a *Combine*. We just need to select the vertices of the neck's union and do a *Merge Vertices*. We have finished the whole body.

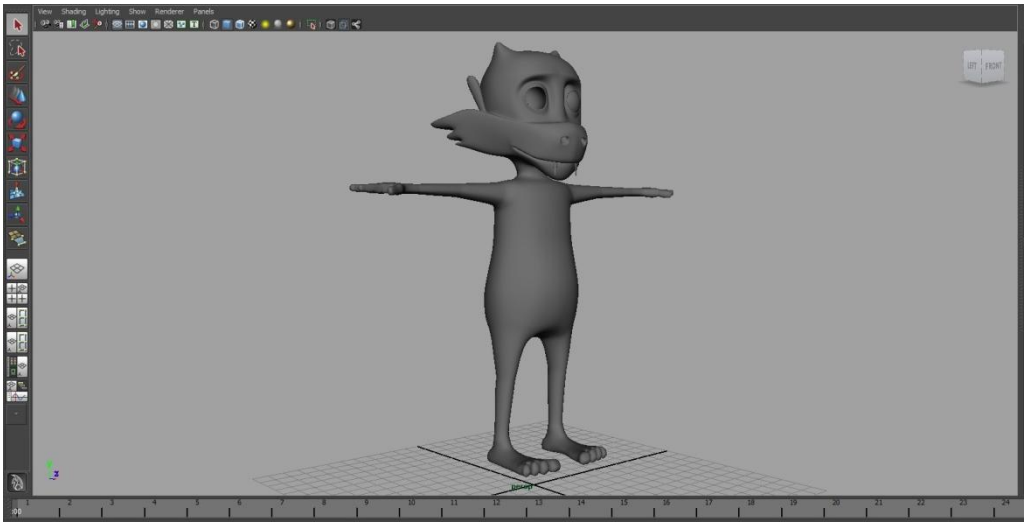


Fig. 3. 9. Txikia's model.

We have our main character created. Now we have to follow the same steps to create Tara and Gogor. We must bear in mind that the body of these two characters are different: both are taller than Txikia, Tara will be thinner because she is a girl, and Gogor will have a strongest constitution.

3.2. Buildings.

3.2.1. Houses.

The houses of Txikia and Tara are the same, the only thing changed is the orientation. The house has three parts: walls, roof and the wall that is on the roof.

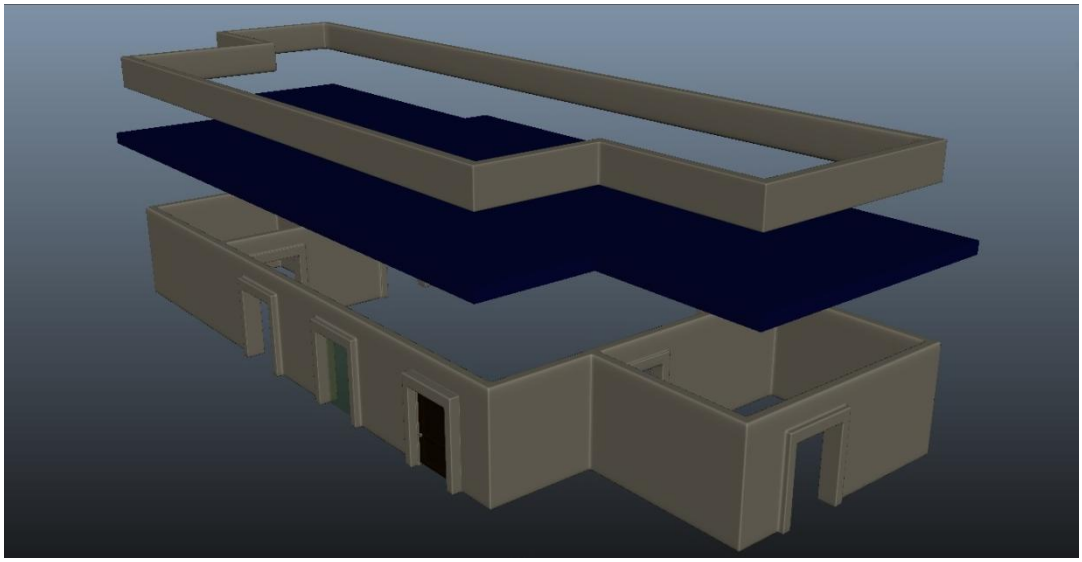


Fig. 3. 10. The three parts of the house modeled.

We follow these steps to create the house:

- First, we create a column from a cube. The column serves to fix the measures of the walls. Now we do a split in the top.
- Now we do the doorframes. We duplicate (Ctrl+D) the column twice and we separated them with the *Move* tool. We select the columns and go to *Mesh > Combine* to have a single object. Now we select the columns' top faces, which are facing each other and, we go to *Edit Mesh > Bridge*, with both faces selected. Now we have the doorframe done, but it has the thickness of the wall, so we select the external faces of the object and we do an *Edit Mesh> Extrude*.

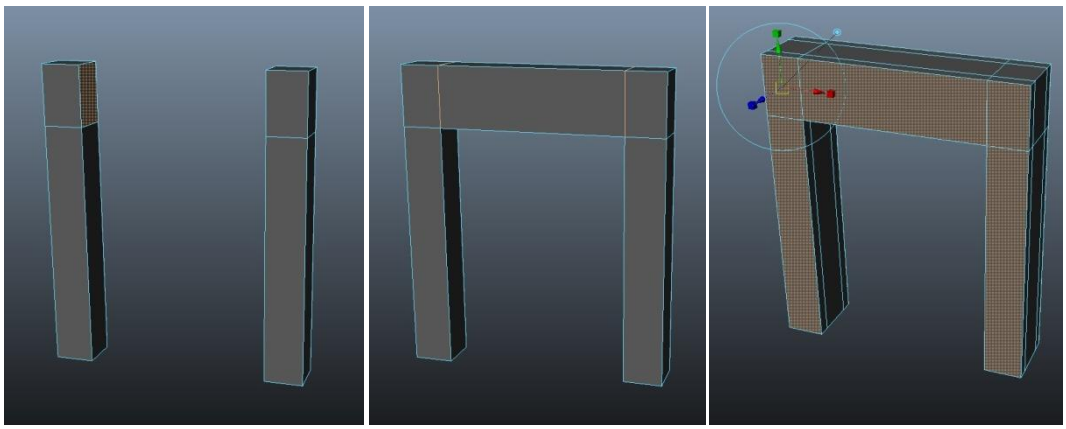


Fig. 3. 11. Steps for creating the doorframe.

- Once we have finished the doorframes and columns, we duplicate them and positioned in their proper place. We put a column in every corner of the house and room, and the doorframes in the place of doors and windows. We see the placement of the elements in the picture below.

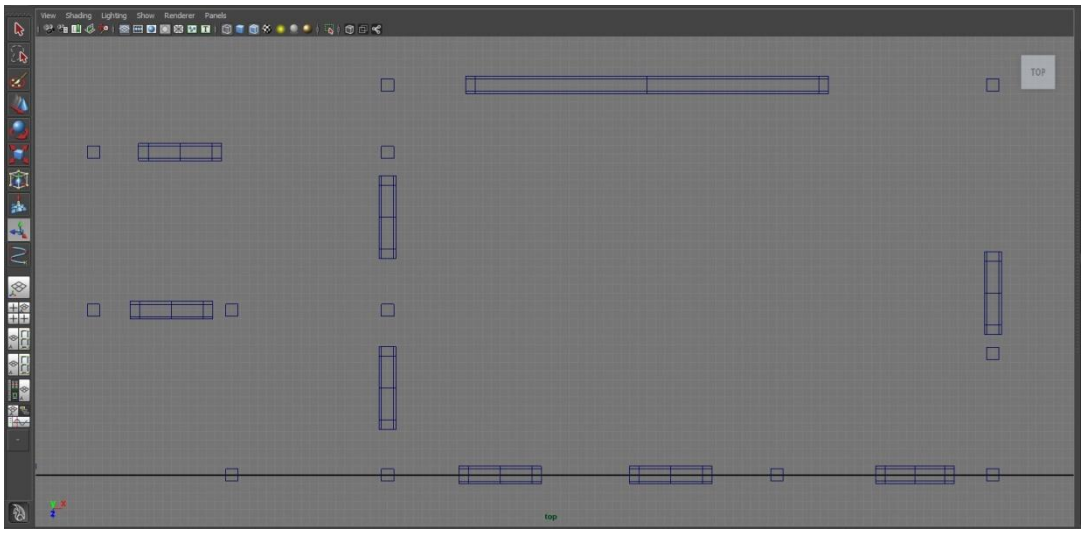


Fig. 3. 12. The position of columns and doorframes.

- We select all the columns and doorframes that we have placed, and we do a *Combine*. Now we have to connect all the faces that are facing each other to create the walls. We do it with the *Bridge* tool. Once we have connected all the faces, we select the top faces of the wall and we extrude them up.

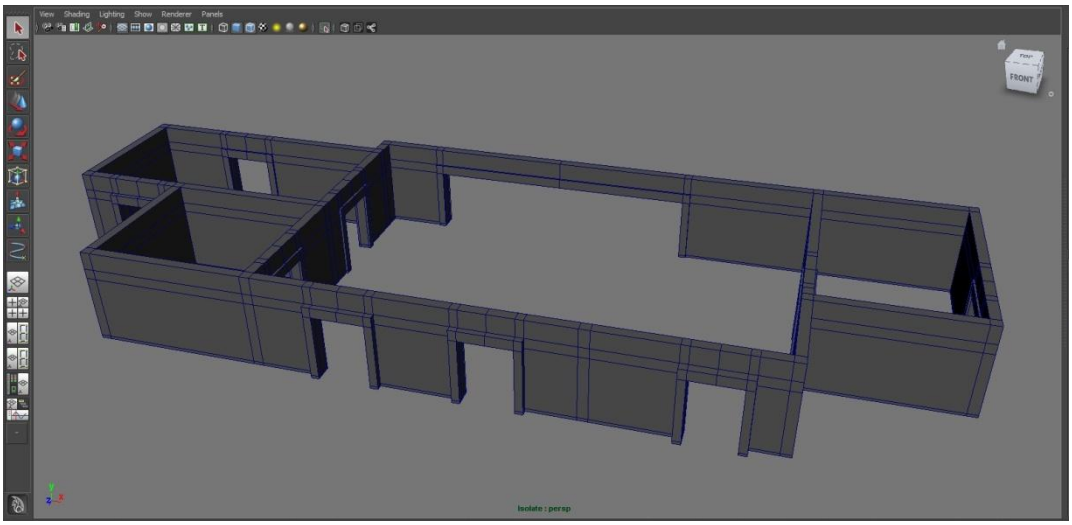


Fig. 3. 13. The walls.

- We create a bow to do the roof. It must have the measure of the central room and low height. We do some divisions at the height of the other rooms and then extrude the sides to create the ceiling of the rooms. We do the divisions with the *Insert Edge Loop* tool in the *Edit Mesh* menu.
- We follow the same process of creating the wall to do the wall that is on the roof.

3.2.2. Building.

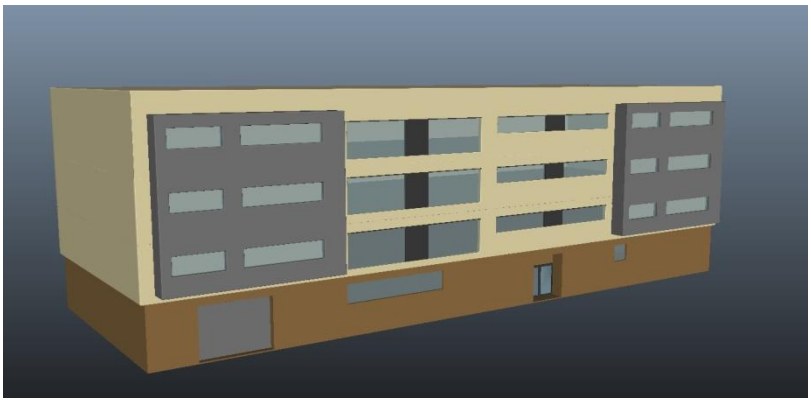


Fig. 3. 14. The building.

The building is very simple, is made from cubes, each floor is one. The steps to create it are:

- We create a cube and we add *Edge Loops* to mark the spaces of windows and doors.
- We select the faces of the windows and doors, and we extrude them inward. Then we eliminate those faces.
- We do the same with upstairs and we duplicated twice to create the second and third floor.
- Once we have created all the floors, we add divisions to make rounded contours. We can see how it looks by pressing the 3 key.

3.3. Landscape.

3.3.1. Mountains.

We start with a plane to create the mountains, we go to *Create> Polygon Primitives>Plane*. We go to the *Channel Box* and press on *polyPlane*, now we increase the subdivisions greatly. We sculpt the geometry to create the relief of the mountains. (*Mesh > Sculpt Geometry Tool*). We vary the brush radius and opacity, and the sculpt parameters, to create the different terrain irregularities until get the shape that we want.

3.3.2. Mushrooms.

In my animation short the trees are mushrooms. I decided to do it like this because, first, I wanted to have every little thing modeled by me, and secondly, because the trees take more render time. In addition, the mushrooms give a touch more fanciful and cartoon.

The mushrooms are composed of two objects: the cap and the stem.

- We create a sphere to make the cap. Then, we take the *Move* tool, with the *Soft selection* selected, and we deform the sphere until get the shape of the mushroom's cap. Each type of mushroom has a different shape.
- We do the stem starting with a cylinder and then, modifying its shape to be more curved.

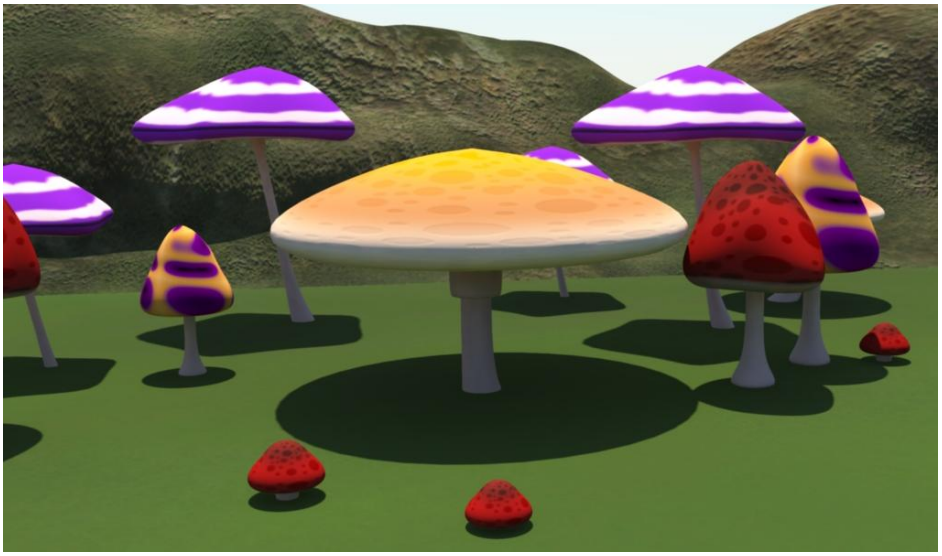


Fig. 3. 15. The mushrooms.

3.4. Forniture and decoration.

3.4.1. Sink.

The sink is composed of three items: the sink, the closet and the water tap.

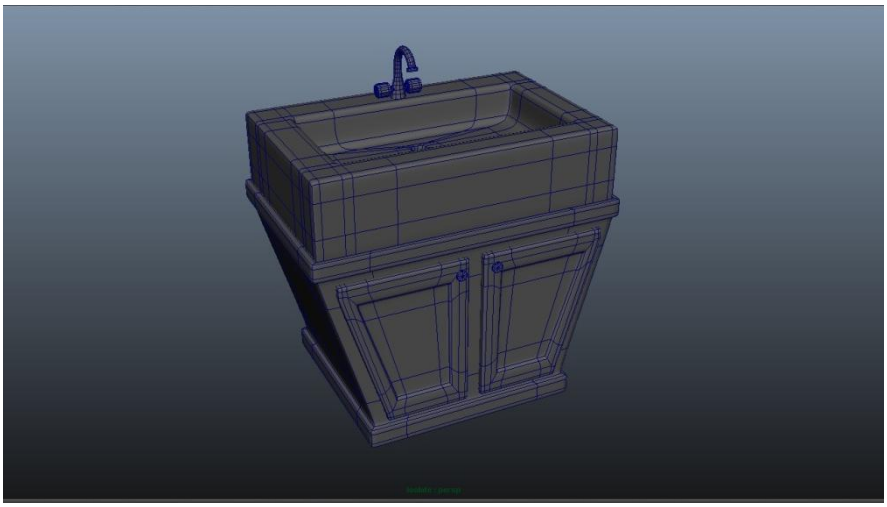


Fig. 3. 16. The sink.

- We make the sink starting with a cube. We add a division parallel to each side of the top face to mark the cavity of the sink. (*Edit Mesh > Insert Edge Loop tool*). We select the new top central face and we do an *Extrude* inward (*Edit Mesh > Extrude*). We make an *Extrude* again and we scale that face to get the drain's dimension of the sink. Now we add some divisions and we move the vertices to get more material to make the drain round.

- We create a cube to do the closet. We add a division in each end off the box, up and down. We select the band of faces of the top and the bottom, and we make an *Extrude* and scale them.

  Now we create another cube to make the door. We add a division parallel to each side of the front face, we select the new central face and we make an *Extrude* inward.
- We create a cylinder to do the water tap. We go to the *INPUTS* in the *Channel Box* and we add enough subdivisions to bend the cylinder. We select the cylinder and go to the *Animation* menu and then to *Create Deformers > Non Linear > Bend*. We can change the attributes in the *Channel Box* and adjust the bending's curve. Now we move the vertices to modify its shape, to do it thicker in the base and tight in the middle.

  We create another cylinder, we add three subdivisions and, we extrude the center faces and we scale them inward.

We add some *Edge Loop* to make the objects more rounded.

3.4.2. Toilet.

The toilet is composed of four items: the toilet, the lid, the cistern and the button.

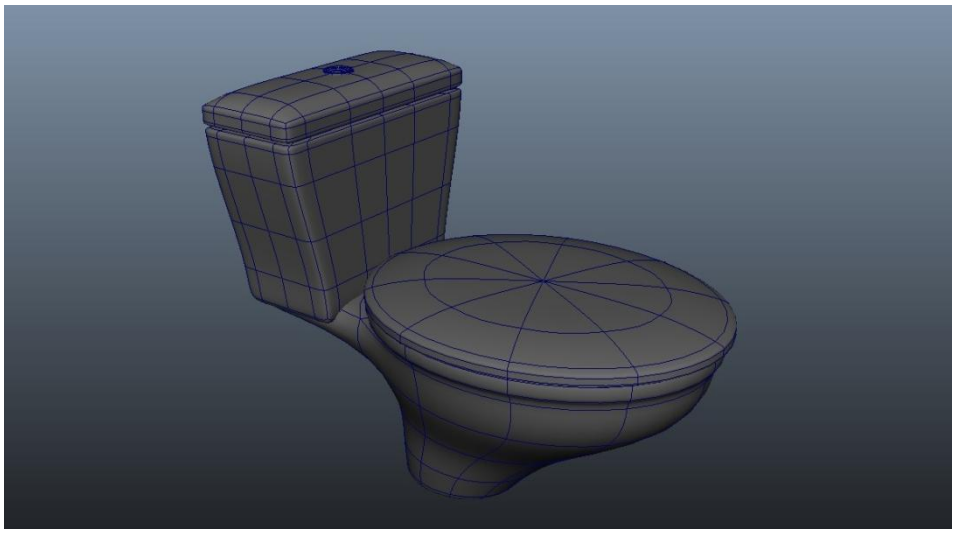


Fig. 3. 17. The toilet.

- We create a cylinder to do the toilet. We take the scale tool and we make oval the cylinder. Then we select the faces of the top and we make an *Extrude* inward to do the hole of the toilet. We move the vertices or edges to make the shape of the toilet,

thicker on top and thinner on bottom. We make an *Extrude* of the two back faces to create the connection to the cistern.

- We create a cylinder to do the toilet lid, we scale the cylinder to make it oval and low rise, and at last, we select the vertices of the center top and we move them to make the lid rounded on top.
- We create a cube to do the cistern and we add some subdivisions. We select the strip below the cistern lid and we scale it inward. We make the top rounded and we adjust the vertices to achieve the desired shape of the cistern.
- We start with a cylinder to make the cistern's button. We select the faces of the top, we make an *Extrude* and we make the faces smallers with the scale tool, then we make an *Extrude* again, but outward. Now we have the primitive shape of the button, we just need to add some *Edge Loop* to finish it.

3.4.3. Shower.

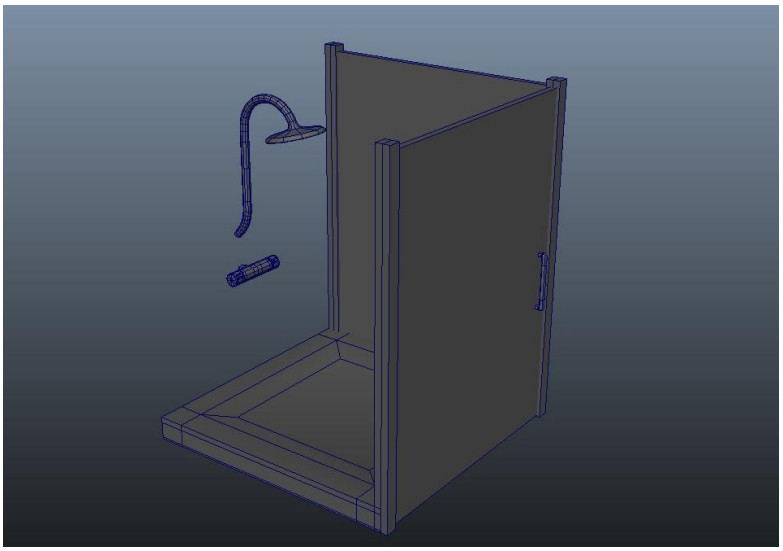


Fig. 3. 18. The Shower

The creation of the shower is very simple, every part of it is an object. The shower enclosure is the easiest to do because they are simple cubes. The mixer tap and the shower head is more complicated:

- We start with a cylinder and we give some subdivisions: 10, in *Subdivisions Axis* and 2, in *Subdivisions Height*.

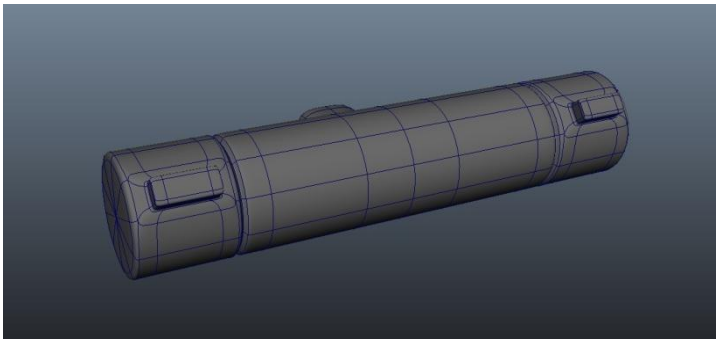


Fig. 3. 19. The mixer tap.

- We go to *Edit Mesh* > *Offset Edge Loop* tool and we add two divisions to mark the two controllers, left and right.
- We select a face of the two extremes and we make an *Extrude* to create the button of each controller.
- We add two E*dge Loops* on each side of the division we have done for making the controllers, and we make the center E*dge Loop* smaller. Thus, appear that there are three pieces.
- Finally, we make an *Extrude* of the two back faces, which are those that will be attached to the wall.

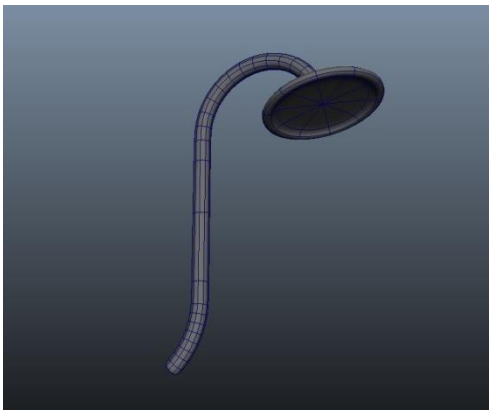


Fig. 3. 20. Shower head.

- We start with a cylinder to make the shower head. The cylinder must be longer than wide.
- We make the curve of the shower head with the *Bend* tool and we modify the settings until get the curve we want (*Animation* > *Create Deformers* > *Nonlinear* > *Bend*).
- We select the faces of the top extreme and we make an *Extrude* to create the shower head.

3.4.4. Cupboard.

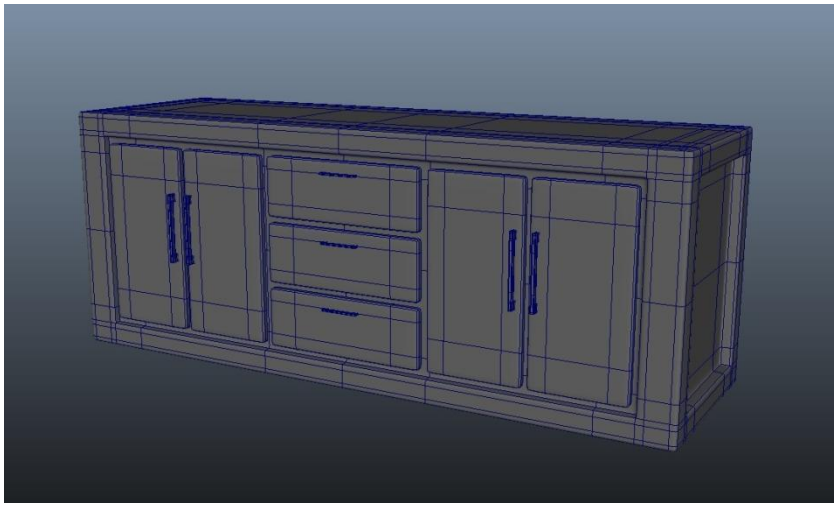


Fig. 3. 21. The cupboard.

The cupboard is composed of three different pieces: the cupboard, the doors or drawers and, the handles.

- We create a cube to do the cupboard. We add a division in each ridge of the cube. We select the bands of faces that touch the ridge of the cube and we make an Extrude outward.
- Now we create another cube and we modify its size depending on whether it is a door or a drawer.
- The handle is made with a cylinder. We add a division in each extreme of the cylinder, then we select the faces of the extremes and we extrude them outward, these faces will be in the doors.

3.4.5. Sofa.

The sofa is composed of two elements: the back and seat. Both parts are made by adding divisions (*Edge Loop* tool) to get geometry and doing *Extrudes* to make that stand out like the armrest or the cushions of the seat.

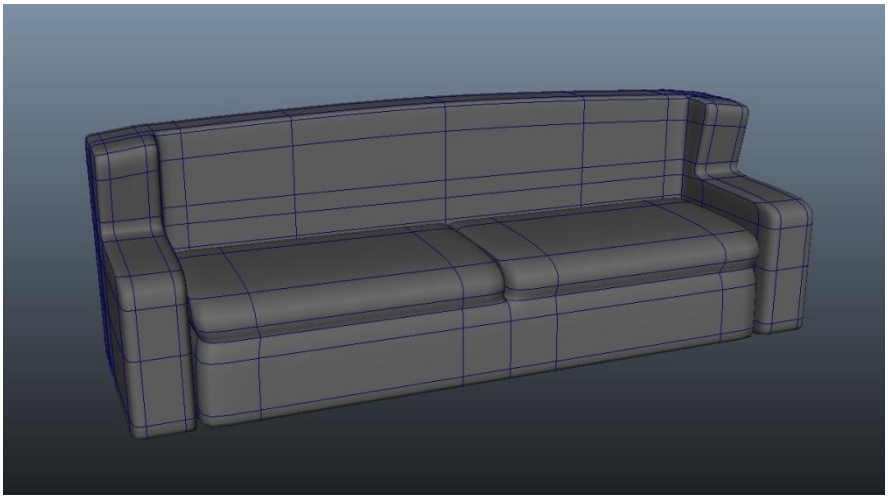


Fig. 3. 22. The sofa.

3.4.6. Table and chairs.

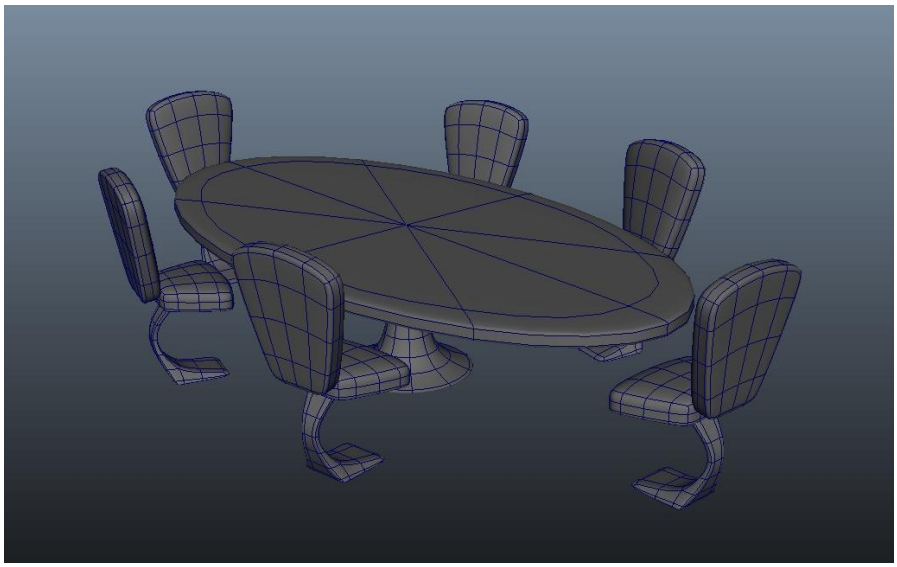


Fig. 3. 23. Table and chairs.

The table top is a simple oval cylinder and the table leg is also a cylinder, but modified with the *Scale* tool to be narrower above than below.

The chairs are composed of three pieces. We start from two cubes to do the back and seat of the table. Then we add some divisions to do the sides rounded and look like it is padding, and then we flatten the back. We make the chair leg with a cube and we add some divisions to have enough geometry to do the shape of the base. Now we extrude the face of the back to create the leg, and we add more Edge Loops to do the semi-circle.

3.5. Motorbike.

The motorbike is made of a set of pieces. The first thing I did was a search for an image reference, in order to create a proportionate motorbike.

Fig. 3. 24. Image reference.

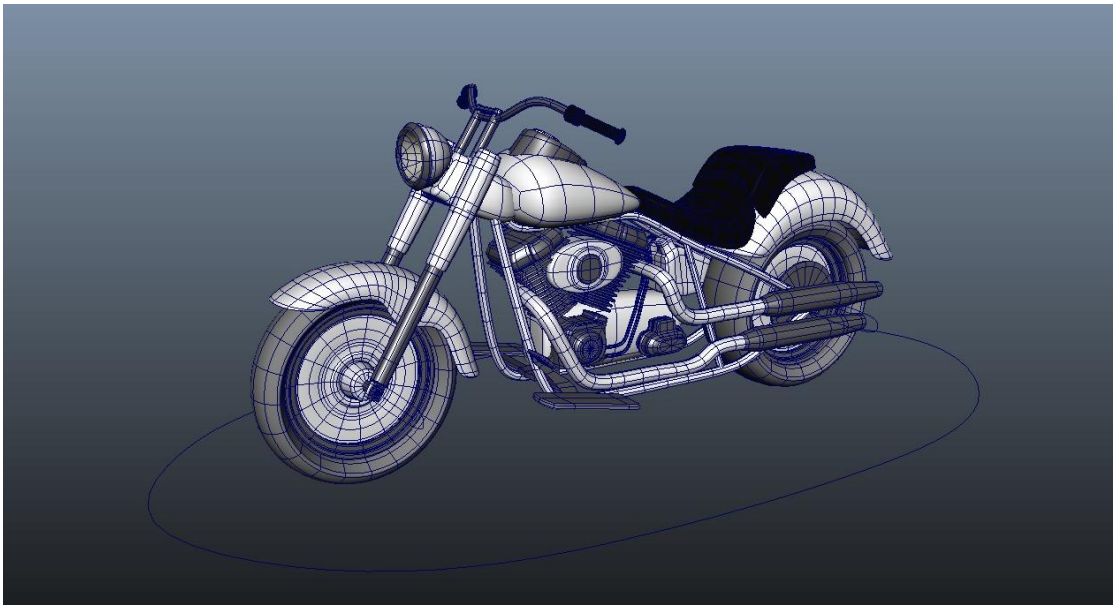


Fig. 3. 25. The motorbike modeled.

We need to follow the next steps:

- The first thing we do is the wheel, which has two pieces: tyre and wheel rim.

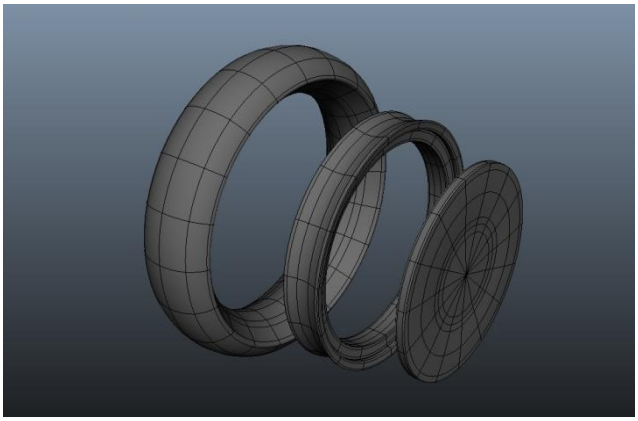


Fig. 3. 26. The wheel.

1. We create a Torus with the size and thickness of the wheel (*Create > Polygon Primitives > Torus*). Now we modify the *Edge Loops* of the internal part of the tyre to adjust it to the wheel rim shape (*Edit Mesh > Insert Edge Loop tool*).
2. We create a cylinder to make the wheel rim and we modify its size to fit it inside the tyre. Now we add *Edge Loops* to the external part of the wheel rim and we adjust it to the tyre shape. Then we add another *Edge Loop* to the cap, we select the central faces and we *Extrude* them to make the two rims of the wheel rim.
3. Finally, we add *Edge Loops* to define the edges and then, we create a group (Cntrl+G) with all pieces of the wheel and we duplicate it to create the other wheel. Remember that the rear wheel is thicker, so we have to modify its dimensions.

- Now we make the petrol tank and the seats, we start with a cube to make each piece and we modify its vertices to get the shape. Remember to press 3 key to see the final shape.

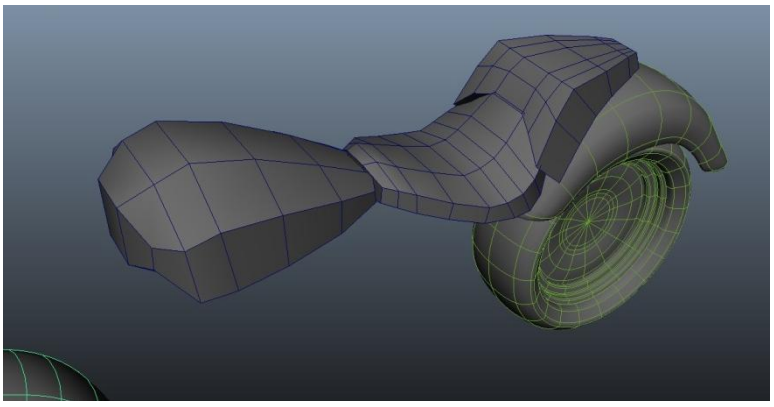


Fig. 3. 27. The petrol tank and the seats without the 3 key pressed.

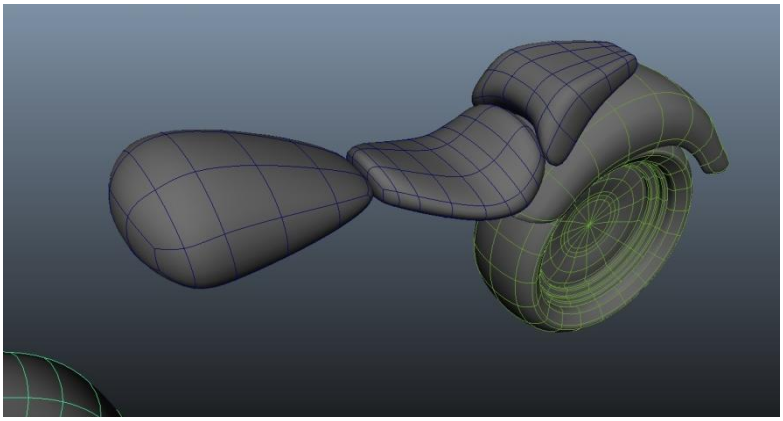


Fig. 3. 28. The petrol tank and the seats with the 3 key pressed.

- The engine has four pieces, two of which are the same, so we just have to duplicate it once made the first.

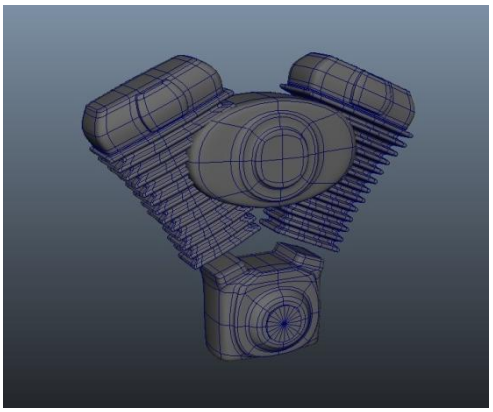


Fig. 3. 29. The engine.

1. We create a cylinder to do the central piece of the engine. We modify the cylinder to be oval. We select the faces of the cap and by the *Estrude* and Scale tool, do the two circles that stand out.
2. We make the piece below starting with a cube. First, we prepare the geometry of the front doing a circle. Then we make various extrudes to do the part that stand out. Now we add some divisions to the top of the object, and then we extrude the faces to do the extremes that stand out.
3. The other two pieces are the same, so we create one and then we duplicate it. We start with a cube and we do a division above the middle of the object. We add twenty five divisions below the division we have done. Now we select the loops of faces that are odd, I mean one in two. Then we do an *Extrude* inward with the faces selected. After that we modify the shape to be thicker above than below, and then we rotate it few degrees.

- The exhaust pipes are modeled differently. The exhaust pipe is composed of two objects: pipe and silencer.

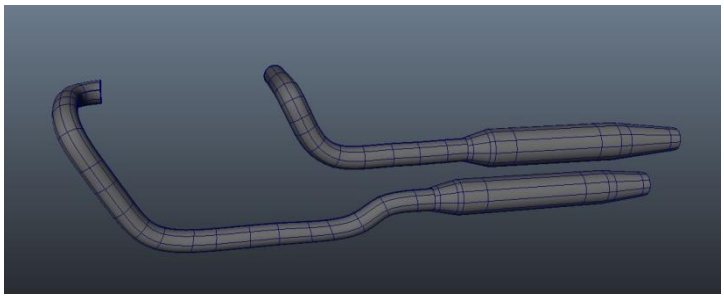


Fig. 3. 30. The exhaust pipe.

1. The pipe is made from two curves: *EP Curve* and *NURBS Circle*. First we draw the shape of the pipe with the *EP Curve* tool. The curve must have many points in order to have a good geometry to create tube. Then we create a circle (*NURBS*) and we position it at the beginning of the other curve. Now we select the circle and then the curve, and we go to *Surface > Extrude,* we open the options box. On *Style* we put *Tube* and press *Apply*. We have the pipe finished, now we have to do the same process to create the other.
2. The silencer is made with a cylinder. We select the faces of the cylinder extremes and we make an *Extrude* inward, then we add some *Edge Loops* and we adjust the shape of the geometry.

The steps above are the most difficult. Once arrived at this point, the creation of the other pieces is to follow the same steps. For example, the chassis, the handlebar and the motor tubes are made following the same steps as the exhaust pipe.

3.6. Box of chocolates.

The chocolate box have the form of a heart, to create it, we start with a box and give them few subdivisions. We modify the vertexs to give the primary shape of the heart, and then we go adding *Edge Loops* to have more material (*Edit Mesh > Insert Edge Loop Tool*). We scale the bottom half of the box, in this manner appears to have cover.

Once we have finished the box, we proceed to do the bow. The bow has three pieces: knot and two pieces of the bow that stand out.

We create the bow by drawing the contour with the *EP Curve Tool*. We duplicate the curve and we move it in parallel. Now we select both curves and go to *Surface* > *Loft*. The knot of the bolw is finished.

We do the two pieces that stand out with the same tool that we created the knot, *EP Curve*, but now we open the option box and on *Curve degree* we put *1 Linear*. Now we draw the contour and then we go to *Surfaces* > *Planar* to fill the curve.

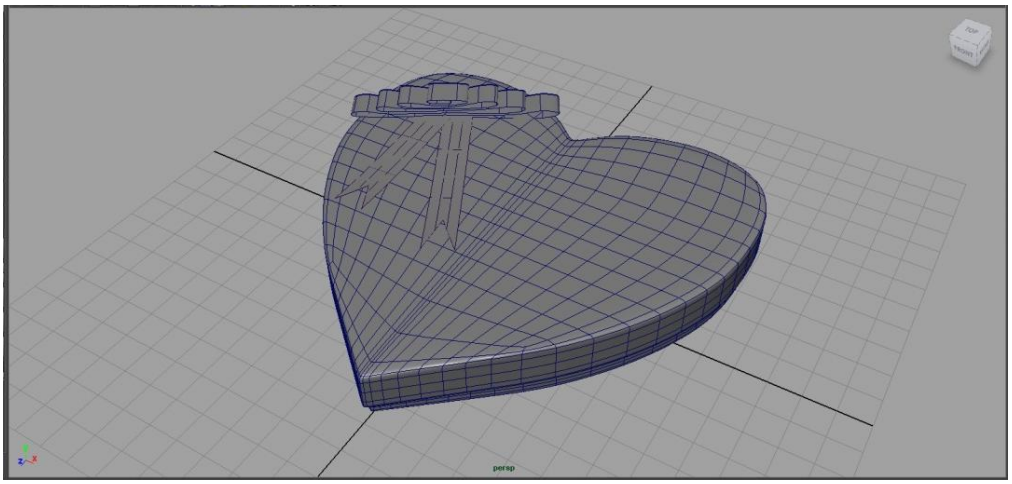


Fig. 3. 31. Box of chocolates.

3.7. Shovel.

As we have seen, it is always easier to model an object if we divide it into pieces. Making a complex object in one piece is much more complicated. Therefore, we will divide the shovel in all possible parts: handle, shaft and blade.

- The handle of the shovel has the shape of a D, so we divided the shape into three: the handle, which is a cylinder, and the two pieces which secure the handle to the shaft. We create a cube to do these pieces, it must be taller than wide. We add *Edge Loops* to have enough material to curve the object. Then we modify the base of the cube to be semi-circle. Once we have finished the object we duplicated it to create the other side. Then, we attached the semi-circle base to the shaft, and the top of the piece to the upper bar of the handle.
- The shaft is a simple cylinder.
- We create the blade starting with a cube, which has to be thin. We add some divisions and we move the vertices to create the shape of the blade. Then, we

prepare the geometry to make an *Extrude* in the area where the shaft has to be attached.

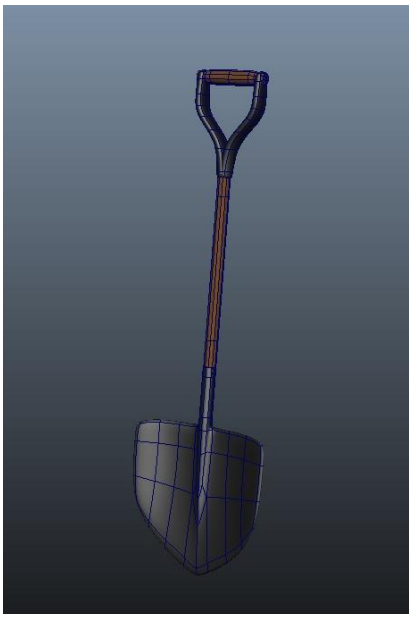


Fig. 3. 32. The shovel.

3.8. Necklace.

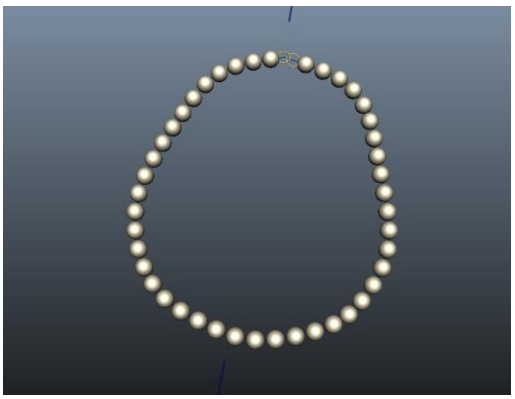


Fig. 3. 33. The pearl necklace.

The pearl necklace is very easy to do because the pearls are spheres and the clasp is composed of two *Polygon Torus*. What we have to do is draw the shape of the necklace with the *EP Curve* tool, then create a sphere with the size of the pearl and duplicate it forty times. Now, we select the pearls and then the curve and, we go to *Modify > Snap Align Objects > Position Along Curve*. Once we have the pearls along the curve, we create a group with all the pearls.

4. Setup, Blend Shape and Skinning.

4.1. Setup.

The setup is the skeleton that will allow the character do all the movements. The skeleton is composed of bones, each of these bones have two joints (J). A controller (CC) will be assigned to every joint. The controller will allow us to move the character without having to touch and modify the skeleton.

The setup of my three characters are made in the same way, they all have the same controls so they all have the same ability to do the moves.

First of all, before we start the Setup, we need to delete the history of our model (*Edit > Delete by Type > History*), and do a freeze transformation (*Modify > Freeze Transformation*). To create the skeleton more comfortably, hide the eyes (Ctrl + H) and put our model in a layer. Now, we can start the process of the skeleton's creation.

1. We stand on the side view and start with the leg's bones. We take the *Joint Tool* (*Skeleton > Joint Tool*) and we click each of the following parts with left button (LB): the top of the leg, knee, ankle, instep and, finally, the end of the foot. Every time we finish placing a series of joints, we have to rename them to make it easier to find them later. When we rename, we have to put all the necessary information, first J of joint, then which part of the body is, and the side it belongs. In this way: J_kneeLeft.

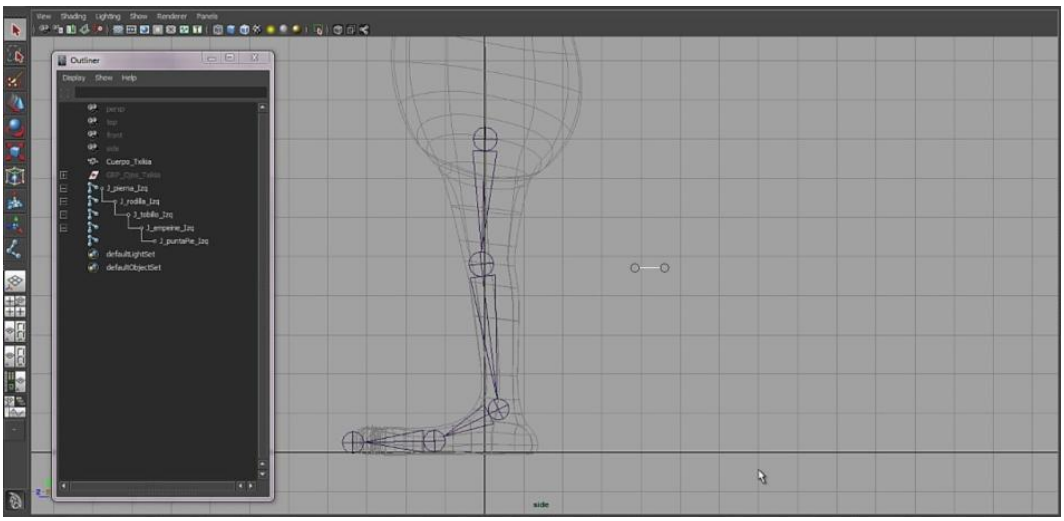


Fig.4. 1. The position of the joints from the side view.

2. All the bones have an orientation, we can see it in *Display* > *Transform Display* > *Local Rotation Axis*. All bones have to follow an orientation, normally the orientation of the knee usually fails. We can change the orientation by selecting the joints and pressing F8 or clicking the Comp*onent* button,  , and then pressing the button *Miscellaneous Objects*,  . Now, we can rotate the joints with the *Rotation tool*, on the left of the display, or pressing E.
3. After orienting the joints, we proceed to place them in their proper place, from the front view. We never use the Rotate tool to place them, we must do it from the *Attribut Editor* > *Joint* > *Joint Orient*.

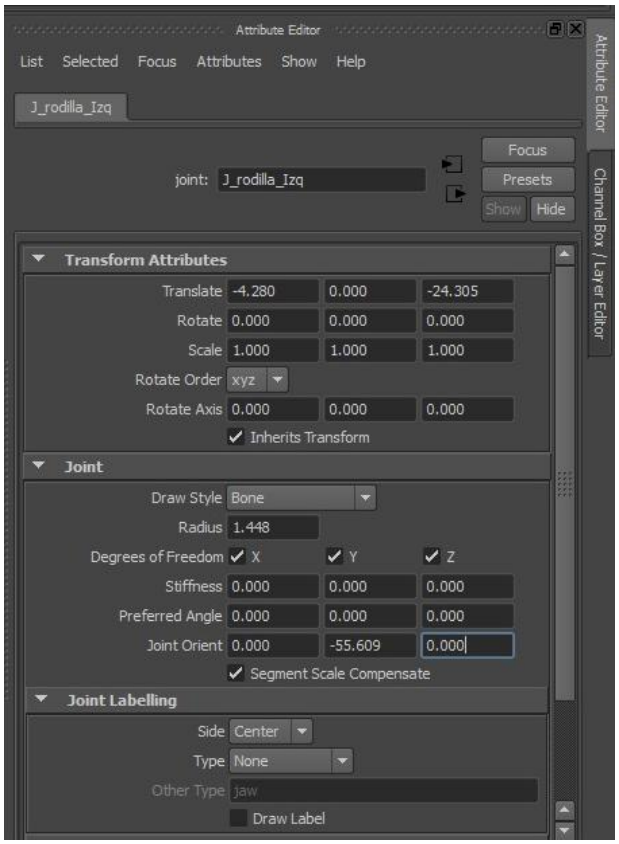


Fig.4. 2. Joint rotation.

4. *IK Handle*, inverse kinematics, is what will move the chain of bones of the leg, so if we raise the foot, the leg will bend. In order to do it we have to go to *Skeleton* > *IK Handle Tool* and open the tool. On the Current Solver we have to change the *ikSCsolver* for *ikRPsolver*. After that, we have to click at the top joint of the leg and then at the ankle, and the *IK Handle* will be done. Now we rename like this: IK_legLeft.

5. RF or *Reverse Foot* is what will allow us do the tread move. That is, to say, lifting the heel without moving the tip of the foot. In order to do the foot bones of the *Reverse Foot* we have to go to the side view and take the *Joint* tool. We start putting the first joint in the heel, and then, the tip of the foot, instep and, in the end, the ankle. As always, we have to rename, for example, like this: RF_heelLeft. From the perspective view, we move the RF at the height of the original foot, and then we take the *Snap Point* tool or we press the (V) button,  , to join each joint of the RF with the original foot, so all the joints must match. At no time should be move the original bones. We can see the placement of the bones in green in the image below.

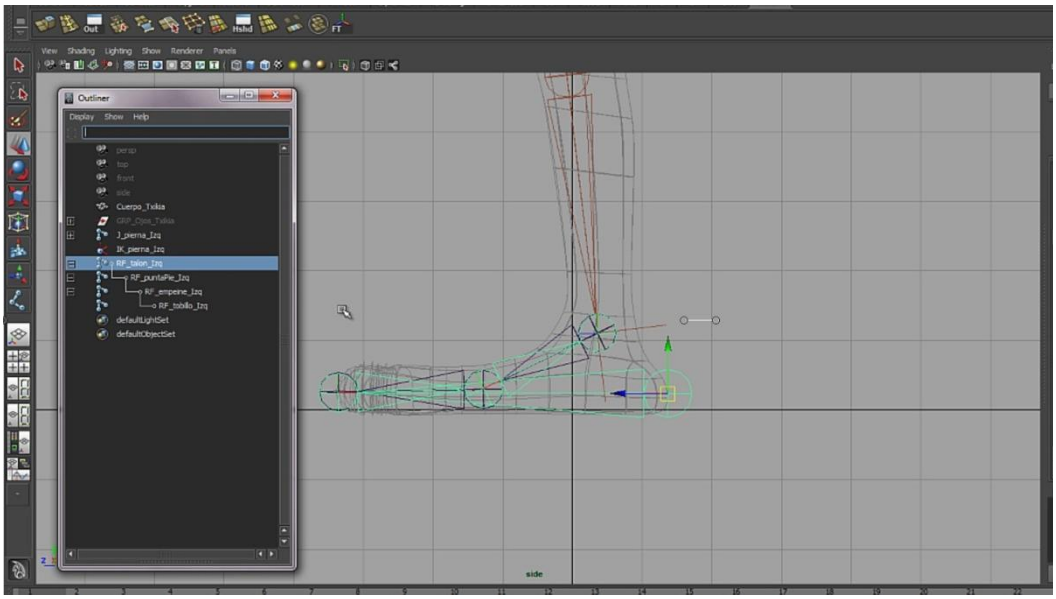


Fig.4. 3. The Reverse Foot.

6. Now we are going to proceed to do the *Constraint*. The Constraints enable you to limit the position, orientation, or scale of an object to other objects. One object is the controller and the other one is the manipulated. In our case, the RF will be the controller. To do the *Constraint* we have to select first the controller and then the manipulated.
    - *RF_ankleLeft* and *IK_legLeft*: Constrain > Point (without Maintain offset).
    - *RF_instepLeft* and *J_ankleLeft:* Constrain > Orient (with Maintain offset).
    - *RF_TipFootLeft* and *J_instepLeft*: Constrain > Orient (with Maintain offset).

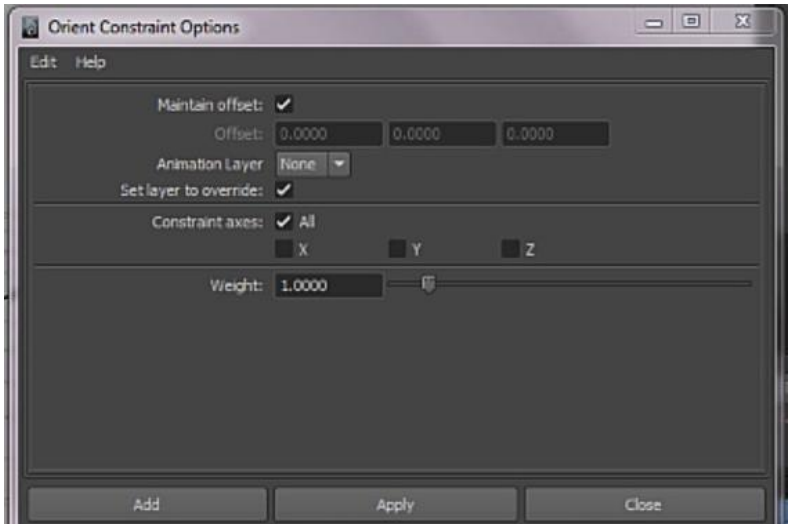


Fig.4. 4. Orient Constraint Options.

7. Once we have done the foot's constraints, we start creating a circle and modifying its points to have the shape of the foot. We rename the curve as *CC_Foot_Left*. This curve will be the foot controller (CC). Then we put the pivot point of the foot controller on the ankle. After all these actions we have to press D to move the pivot point, and we have to press (V) or click on *Snap to Point* to center it on the ankle.
8. Now it is time to create the right leg doing a *Mirror Joint* (*Skeleton > Mirror Joint*). We open the tool to change some settings:
    - Mirror across: YZ
    - Search for: Left
    - Replace with: Right

    The *Mirror Joint* only duplicates the chain of bones, so we have to repeat the *Constraints* in the right leg, otherwise it will not work well. We do not have to forget to delete the *Constraints* from the *Outliner* (*Window > Outliner*) before redo them.

9. We have to duplicate the foot controller too. We have to do a group with the controller (Cntrl+G), duplicate (Cntrl+D) and scale in the x axis, in negative, and finally eliminate the group of the controller (*Edit > Ungroup*). We have to do a *Freeze Transformation*, delete history and rename the duplicated controller as usually.
10. We have to create three controllers, circles, in order to be able to do all the foot movements: one for the heel, another for the instep, and the last one for the tip of

the foot. Each controller has to have the pivot point in the corresponding joint of the reverse foot. We cannot forget to: do FT, delete history, rename and duplicate the controllers for the right foot.

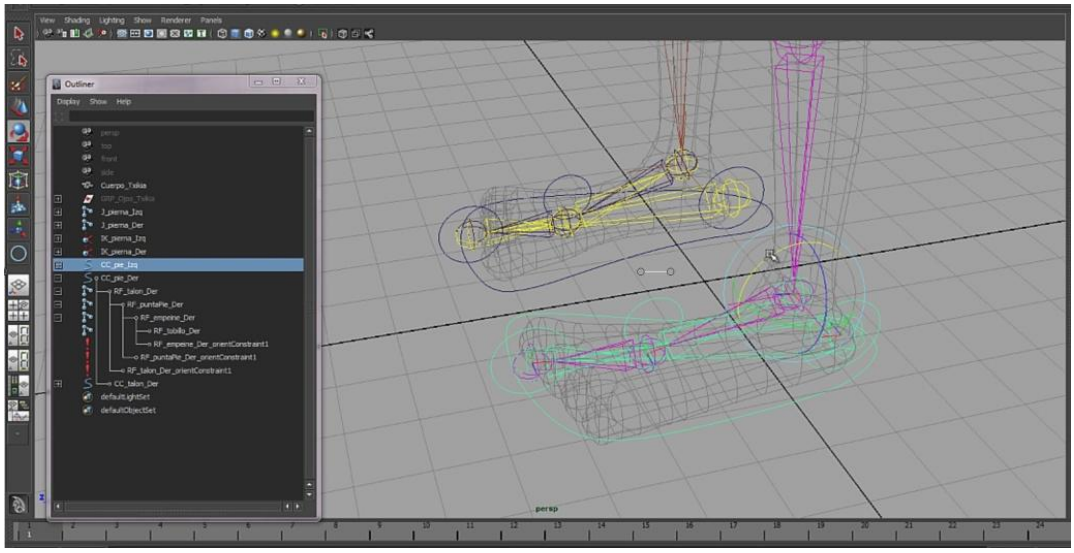


Fig.4. 5. The controllers of the foot.

11. Now we proceed to do the constraints of the foot's controllers. But before that, we have to do a *Parent* of the *J_heel* with the *CC_foot*, pressing P.
    - *CC_heel* and *RF_heel*: Constraint > Orient (with Maintain offset).
    - *CC_instep* and *RF_instep*: Constraint > Orient (with Maintain offset).
    - *CC_TipFoot* and *RF_TipFoot*: Constraint > Orient (with Maintain offset).

    We should check that all the constraints are well done by rotating (E) the controllers. Then, we have to repeat the constraints with the other foot.

12. After doing all the *Constraints* we proceed to do the *Parents* (P), which are necessary to have all the controllers connected. The role of *Parents* is to create a chain of power indicating who are the son and the father. The child will follow the father's footsteps, so if we move the father, the child will move with it. However, if we move the child, the parent will maintain its position.
    Once we understand the theory we can proceed to do the *Parents*. First we have to select the son and then the father, and press P.
    - *CC_instep* is the son of *CC_TipFoot*.
    - *CC_TipFoot* is the son of *CC_heel*.
    - *CC_heel* is the son of *CC_Foot*.

13. Every time that we create a controller, we should block all the controls that are not going to be used, in the case of the foot's controllers, the scale for example. We have to go to *Windows* > *General Editors* > *Channel Control* to block any control.
14. Now we are going to do the controller for the knee. We have to position us on the side view, then we create a circle, we do a snap to the joint knee and, we move the circle forward with the tool *Move* or pressing W. We cannot forget to: do FT, delete history and rename (*CC_kneeLeft*).
15. As you already know, we have to do the *Constraints* when we create a controller. We select the *CC_knee_Left* controller and then the IK Handle *IK_legLeft*, and we do a *Pole Vector Constraint*. After that, we should block the scale and rotation controls of the *CC_kneeLeft* controller. And we do the same with the other leg.
16. Once we *Setup* the leg, we continue with the hip. We have to go to the side view to create the hip right in the middle of the body. We go to *Skeleton* > *Joint Tool* and then we click high over the leg bone. We select the top joint of the legs, then the created joint, and we do a *Parent* (P). We rename the joint as *J_hip*.
17. We take the tool *Curve-Linear* to do the hip's controller. We move the controller to the center of the joint. Do not forget to: do FT, delete history, rename as *CC_hip*. Doing a different shape for the hip's controller is helpful for the animators. We can see the shape of the controller in the image below.

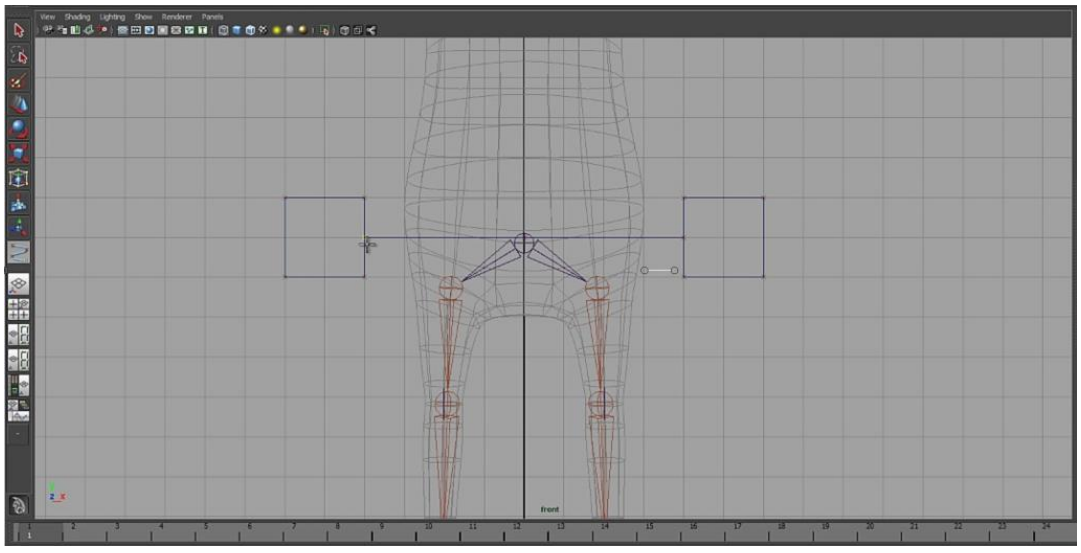


Fig.4. 6. The controller shape of the hip.

18. Now we select the controller, *CC_hip*, and then the joint, *J_hip*, and we do an *Orient Constraint*. After that, we block the scale and translation controls of the hip.

19. One of the most important joint is the root, which is the center of gravity. We position the joint just above the hip and we rename it as *J_COG*. We do a *Parent* of the *J_hip*, "the son", with the *J_COG*, "the father".
20. After creating the root, we proceed to create the spinal column, which has six joints: lumbar, back, chest, neck, head and tip head. We do a *Parent* of the *J_lumbar*, "the son", with the *J_COG*, "the father". We create a controller for each joint of the column. We can see the position of the joints in the image below.

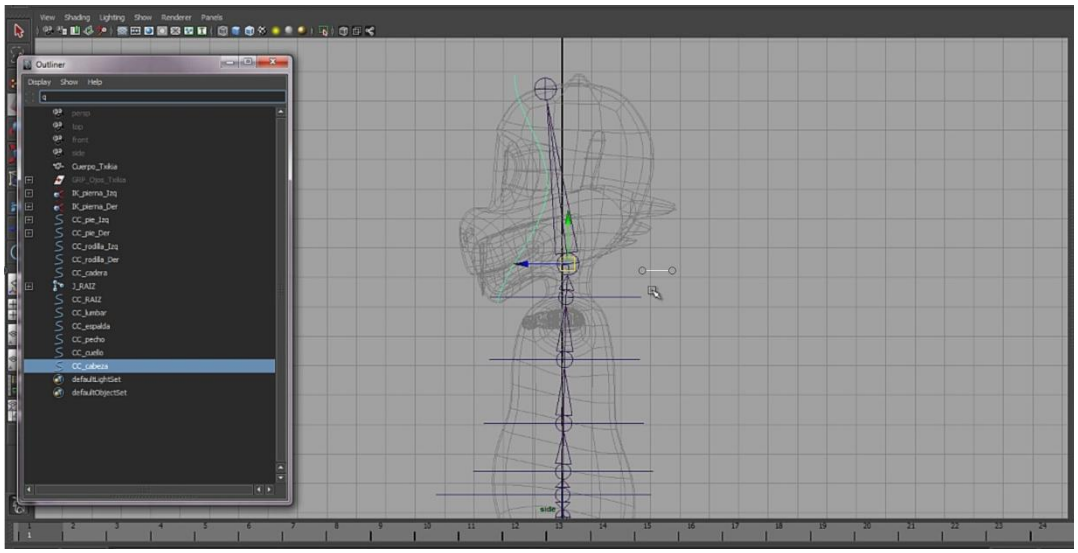


Fig.4. 7. The spinal column with the controllers.

21. We have to do two types of Constraints:
    - Parent Constraint for the *CC_COG*.
    - Orient Constraint (with Maintain Offset) for the controllers of the spinal column.
22. We do the chain of power or *Parents* (P):
    - *CC_TipHead* is the son of *CC_head*.
    - *CC_head* is the son of *CC_neck*.
    - *CC_neck* is the son of *CC_chest*.
    - *CC_chest* is the son of *CC_back*.
    - *CC_back* is the son of *CC_lumbar*.
    - *CC_lumbar* is the son of *CC_COG*.
    - *CC_hip* is the son of *CC_COG*.

    Do not forget to block the controls of the controllers:
    - For *CC_COG*: block scale controls.

- For spinal column controllers: block scale and translation controls.

23. It is easier to animate a character if the drivers are in different colors. It is better to differentiate between left and right sides. In that way, if we decide to change the color, we go to *Attribute Editor* > *Object Display* > *Drawing Overrides*, and click on Enable Overrides. Now we can change the color by moving the slider.

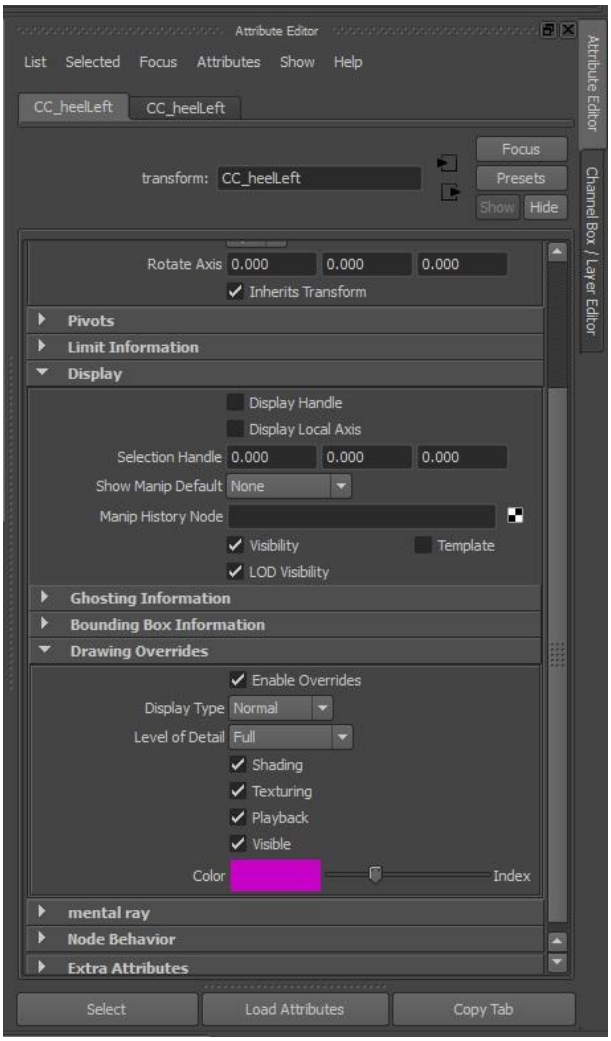


Fig.4. 8. Attribute Editor: Drawing Overrides.

24. Once we have finished the *Setup* of the spinal column, the arms are all that remains to do. We go to the top view to do the chain of the arm, it will have three joints: *J_shoulder, J_elbow* and *J_wrist*. We cannot forget to reorient the joints (*Attribute Editor* > *Joint* > *Orient*).
25. Now it is time to create the hands. In our case we only have four fingers: pinky, middle, index and thumb. Each one has four joints that we rename as: *J_pinkyLeft_01, J_pinkyLeft_02, J_pinkyLeft_03* and *J_pinkyLeft_End*. After that, we create a joint that will be the palm. Finally we do the *Parents* (P):

- Fingers are the sons of palm.
- Palm is the son of wrist.
- Shoulder is the son of chest.

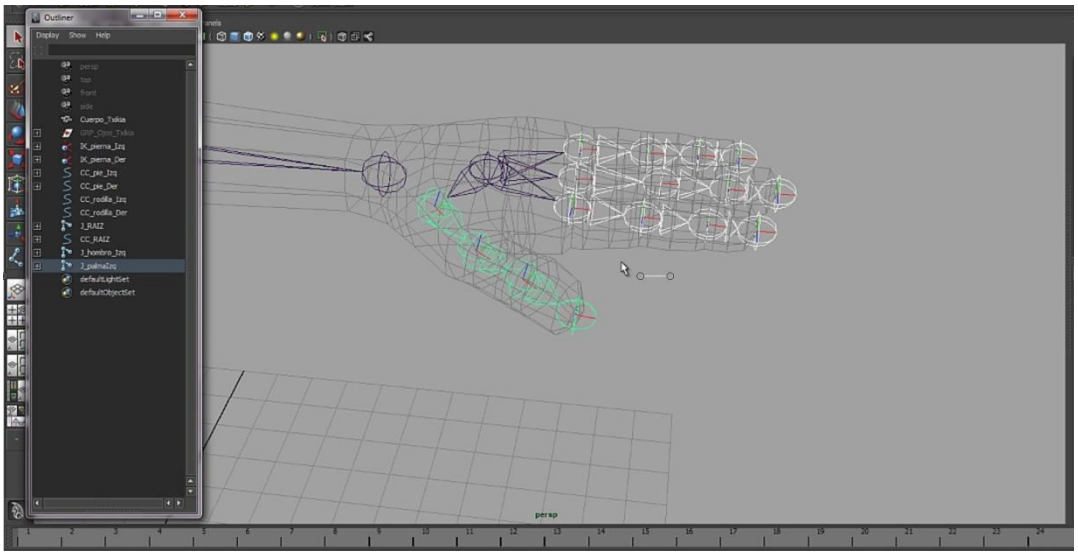


Fig.4. 9. The joints of the hand.

26. As we already know, we have to do a *Mirror Joint* to create the other arm. First we select the *J_shoulder*, and then we do the *Mirror*.
27. Once we have got the arms, we create three controllers for the arms: *CC_shoulder*, *CC_elbow* and *CC_wrist*. We do an *Orient Constraint* and, we block the scale and translation controls.
28. The controllers for the fingers are a bit more complicated. The fingers only need one controller for each one, which we position at the beginning of the finger. Then we block all controls except rotate, and now, we add another two controls that will be used to bend each finger joint.

    We go to *Channel Box > Edit > Add Attribute*. We put *Float* on *Data Type*. To create the control we put the name of the new control on *Long names* and then we press *Add*. We have to create two controls named *Mid Z* and *End Z.*

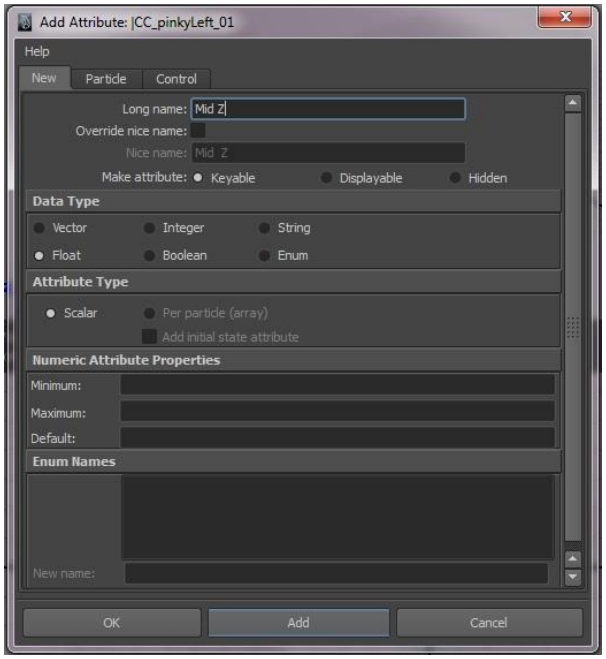


Fig.4. 10. Display: Add Attribute.

29. The new controls are already made. Now we have to do the connections of the controllers with the joints. We have to open the *Connection Editors*, going to *Window > General Editors*. In the display we can see two boxes: Outputs and Inputs. In the box of *Outputs*, we have to put the controllers, and in the box of *Inputs*, we have to put the joints. To make the connections, we have to follow these steps:
    - Select the controller and click the bottom *Reload Left*.
    - Select the joint *J_name_01* and click the bottom *Reload Right*. Now select, on the left box, *rotate* and, on the right box, *rotate*.
    - Select the joint *J_name_02* and click the bottom *Reload Right*. Now select, on the left box, *Mid Z* and, on the right box, *rotate z*.
    - Select the joint *J_name_03* and click the bottom *Reload Right*. Now select, on the left box, *End Z* and, on the right box, *rotate z*.
    - We have to do the same with the other fingers.

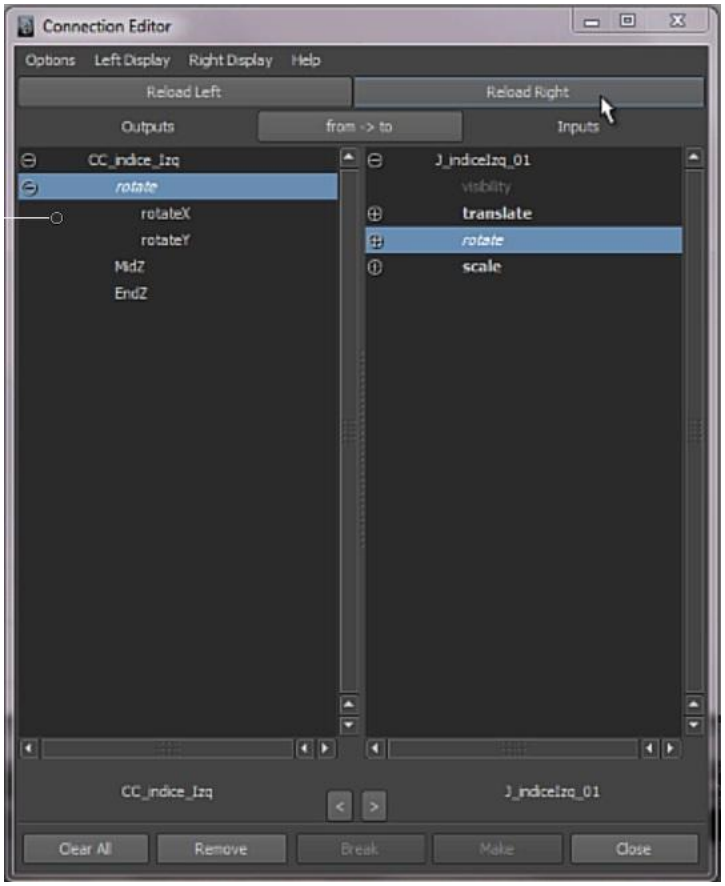


Fig.4. 11. Connection Editor.

30. The *Parents* of the arms controllers:
    - The controllers of the fingers are the sons of *CC_wrist*.
    - *CC_wrist* is the son of *CC_elbow*.
    - *CC_elbow* is the son of *CC_shoulder*.
    - *CC_shoulder* is the son of *CC_chest*.
31. The setup is finished, we just need to create a positioner. We create a circle in the centre surrounding our character, and we rename it as *CC_father*. After that, we create another circle, we shape it and we rename as *CC_positioner*.

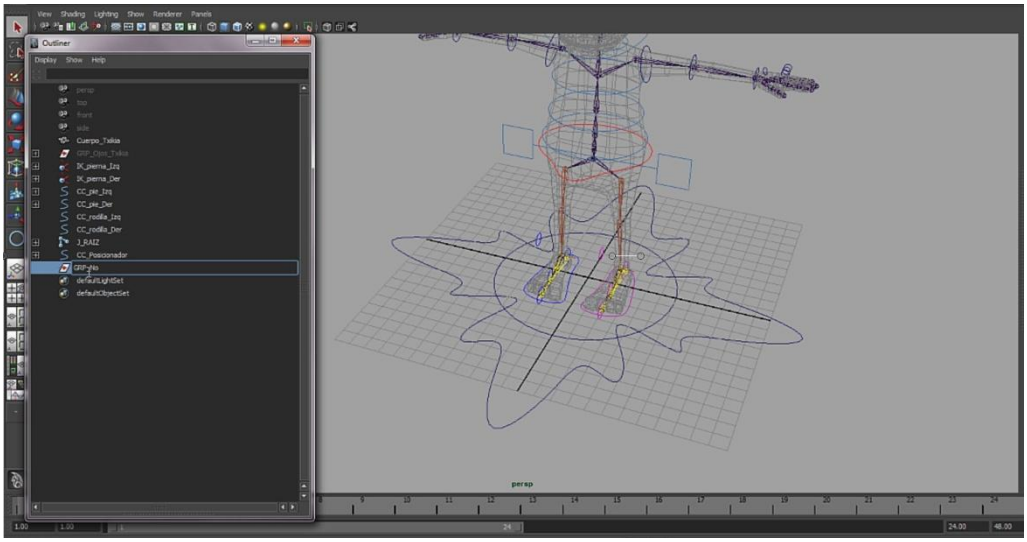


Fig.4. 12. The father and positioned controllers.

32. We have to do the last *Parents* (P):
    - *CC_COG* is the son of *CC_father*.
    - *CC_foot* is the son of *CC_father*.
    - *CC_knee* is the son of *CC_father*.
    - *CC_father* is the son of *CC_positioner*.
33. The last step we need to do is order the *Outliner* following these steps:
    - We have to create two groups: *GRP_NoVisible* and *GRP_Visible*.
    - We put the controllers in the *GRP_Visible*.
    - We select the two *RF_heel* and we hide it by pressing Cntrl+H.
    - We select *J_COG* and we do a group (Cntrl+G) named *GRP_Joints*.
    - We select the two *IK_leg* and we do a group named *GRP_IK*.
    - We put *GRP_Joints* and *GRP_IK* in the group *GRP_NoVisible*.
    - We put the eyes and the modeling body in the group *GRP_Visible*.
    - We create another group called *GRP_SetupCharacterName*, and we put the two groups (*GRP_Visible* and *GRP_NoVisible*) inside.
    - If we scale the *CC_positioner* and the bones do not scale, it is because we need to make a last *Constraint*. We select the *CC_positioner* and the group *GRP_Joints*, and we do a *Scale Constraint*.

4.2. Setup faces expressions.

Facial expressions are made using blend shapes and then doing *Set Driven Key*. The blend shapes allow us to change the form of one object into the shapes of other objects with the same number of vertices. It is very common to use blend shapes in character setup, because we can set up poses for facial animation.

Doing the facial Setup:

1. We have to duplicate the mesh of the character as many times as expressions it has. We should have in count that, in animating, is better to have each side of the face separately. We have to rename the mesh to find things easier in the Blend Shape Window.
2. When we have all the copies of the mesh, we proceed to deform the mesh to get the shape of each expression of our character.
3.

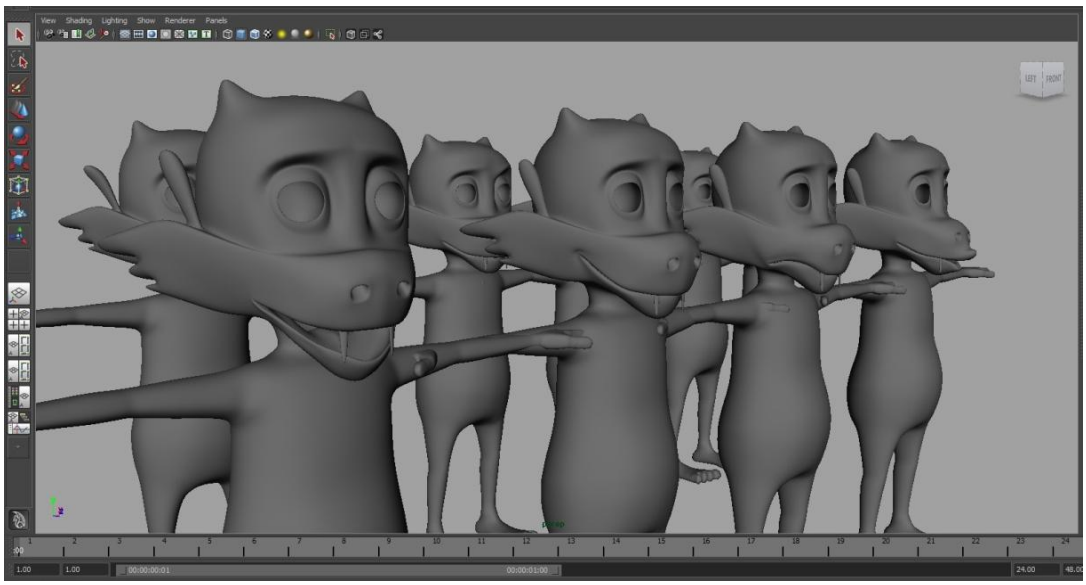


Fig.4. 13. Txikia Blend Shape.

We can see, in the table below, that not all the characters have the same expressions, because not all of them have the same necessities. As we can see, Txikia is the character which has more expressions according to the story.

EXPRESSIONS	TXIKIA	TARA	GOGOR
Eyes closed (separately)	X	X	X
Eyebrows up (angry)	X	X	X
Eyebrows down (sad)	X	X	X
Eyebrows down (tired)	X	-	-
Left eyebrow up	X	X	-
Right eyebrow up	X	X	-
Left eyebrow down	X	X	-
Right eyebrow down	X	X	-
Big mouth open	X	X	X
Small mouth open	X	-	-
Mouth smile	X	X	X
Mouth sad	X	X	X
Kiss	X	X	-
Antennas	X	X	X

Table. 2. Expressions.

4. We select all the modified mesh, then select the base mesh, with all this selected we go to *Window > Animation Editors > Blend Shape and* select *Edit > Create Blend Shape*. All the Blend Shapes must display on a single horizontal line. We can check the Blend Shape by moving the slide bar up and down.
5. Once we have all the shapes with the expressions, we are going to create the panel with the facial controllers. The control panel is composed of sliders. We need to create two circles to do each slider, one serves as a guide to mark the boundaries of the controller and the other is the controller.

   We follow the next steps to do the controllers:

   - We create two circles (from the front view) and modify its shape to be elongated. We create two circles and we modify its shape to be elongated.

We put one of the circles vertically, which will be the slider bar, and the other horizontally, which will be the control. We do a *Freeze Transformation*, delete history and rename.

- We do a *Parent* (P) of the vertical circle (son) and the horizontal circle (father).
- Now we go to the *Attribute Editor>Limit information>Translate*, here we can establish the limits of our control. We click in the box at the right of *Trans Limit Y* and we change the limit to 0. Then we click in the box positioned rightmost and we change the limit to 2. We cannot move the control beyond the scroll bar, once established the limits.

Fig.4. 14. Limit Information options box.

- We should block all the controls except Translation Y, after creating the controller and establishing the limits. Remember to go to *Windows > General Editors > Channel Control* to block any control.
- Now we duplicate the controller as many times as Blend Shapes we have. We rename those duplicated.

After doing the controllers, we create a box for each group: eyes, eyebrows, mouth and antennae. In this way, the control panel looks more orderly.

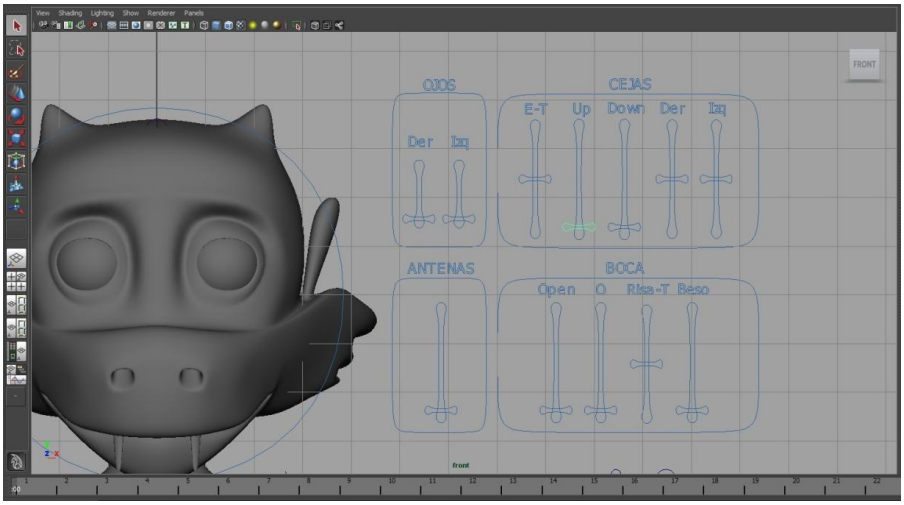


Fig.4. 15. Txikia's control panel.

6. When the control panel is made, we connect the controls of the Blend Shape Display with the controllers of our panel. We do the connections with the *Set Driven Key* tool, we go to the animation's menu and click on *Animate* > *Set Driven Key* > *Set*. As we can see in the image below, the display has two boxes: driver and driven.

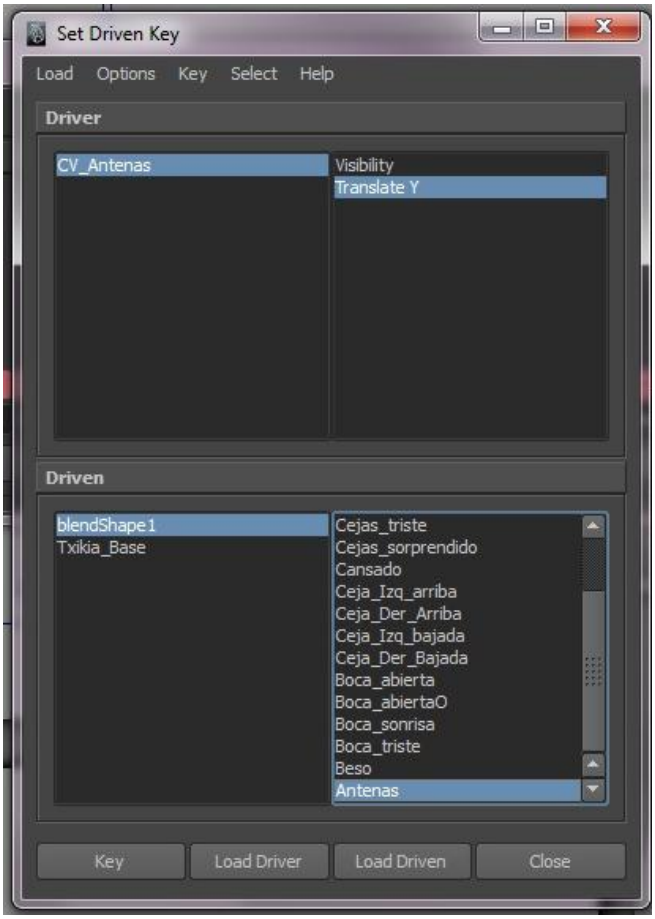


Fig.4. 16. Set Driven Key display.

We follow the next steps to do the *Set Driven Key*:

- We select the original mesh and go to the *Channel Box* and select *blendShape1*. We click on *Load Driven* in the *Set Driven Key* display. On the right side of the *Driven*'s box we can see all our Blend Shapes. Now we select one expression of the *Driven*'s box.
- Now we select our controller of the expression selected and click on *Load Driver*. We can see on the right side of the *Driver*'s box that there is only one control, *Translate Y.*
- First we have to make sure that everything is at 0 in the *Blend Shape* display and the *Channel Box,* and then we click on the button *Key*. We can see that our expression is now in red in the *Blend Shape* display.
- Now we have to move our controller up, to 1, and move the *Blend Shape* up, to 1, and then, we press *Key* again on the *Set Driven Key*.

We have our first facial control after doing these steps. Now we do the same with the other controls and expressions. When we finish all the controllers, we do a group (Cntrl+G) with all of them, and we rename as *GRP_CC_Expressions*. We do a *Point Constraint* of the *CC_head* to the *GRP_CC_Expressions*, and a *Scale Constraint* of the *CC_positioner* to the *GRP_CC_Expressions*.

7. Once we have all the connections of the control panel done, all that remains to do is the controllers of the eyes.

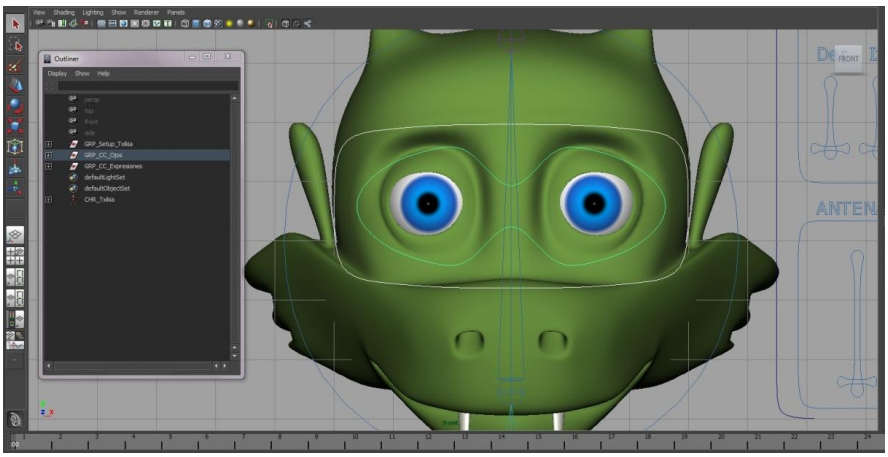


Fig.4. 17. The controllers of the eyes.

We create two circles and we give them shape. We put one of them inside the other, so one is smaller. We rename the small one as *CC_eyes* and the other as *CC_BoxEyes*.

8. Now we do a *Parent* of the small one to the big one, and we make a group with both and rename as *GRP_CC_Eyes*. We do the following *Constraints* to finish the *Setup*:
    - *CC_head* and *GRP_CC_Eyes*: *Parent Constraint*.
    - *CC_eyes* and *LeftEye*: *Aim Constraint* (press Object Up).
    - *CC_eyes* and *RightEye*: *Aim Constraint* (press Object Up).
    - *CC_positioner* and *CC_BoxEyes*: *Scale Constraint*.

We do the *Character Set*, once we have finished the whole *Setup*. We go to *Show > None*, and then *Show > NURBS Curves*, now we only see the controllers. We select the controllers by hierarchy order. With all the controllers selected, we go to *Character> Create Character Set* and we open the options box. We write CHR_ + name of our character (*CHR_Txikia*) and, on *Attributes* we have to put *All keyable except: Scale* and *Visibility*.

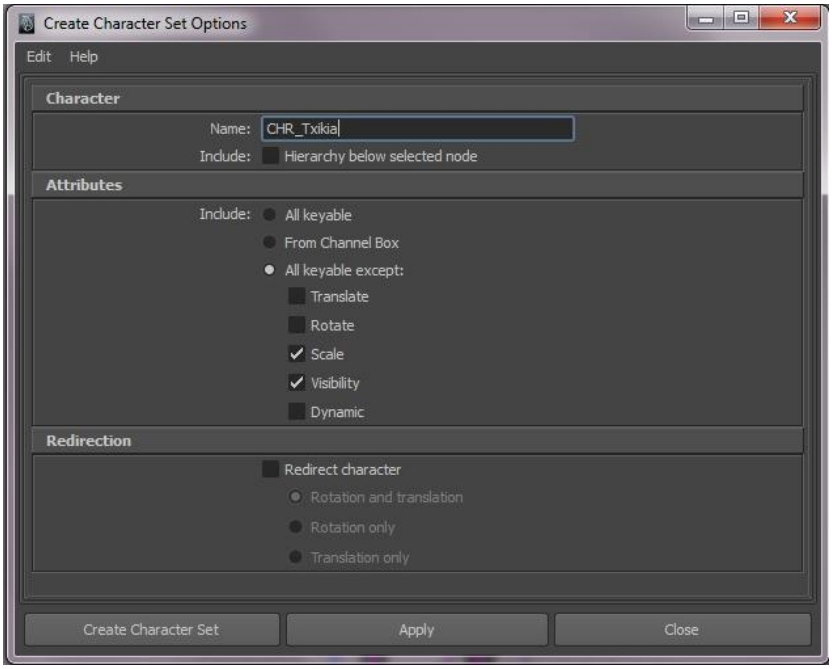


Fig.4. 18. Create Character Set Options.

4.3. Skinning.

The function of the *Skinning* is to connect the character's mesh with its skeleton, so that it can be deformed by moving the controllers. We follow the next steps to do the *Skinning*:

1. We select the character's mesh and the *J_COG*, and we go to *Skin* > *Bind Skin* > *Smooth Bind* and we open the options box. We change the settings bellow and we press *Apply*.
    - Bind to: *Joint hierarchy*.
    - Bind method: *Closest distance*.
    - Skinning method: *Weight Blended*.
    - Normalize weights: *Interactive*.
    - Max influences: *2*.
    - Drop off rate: *2*

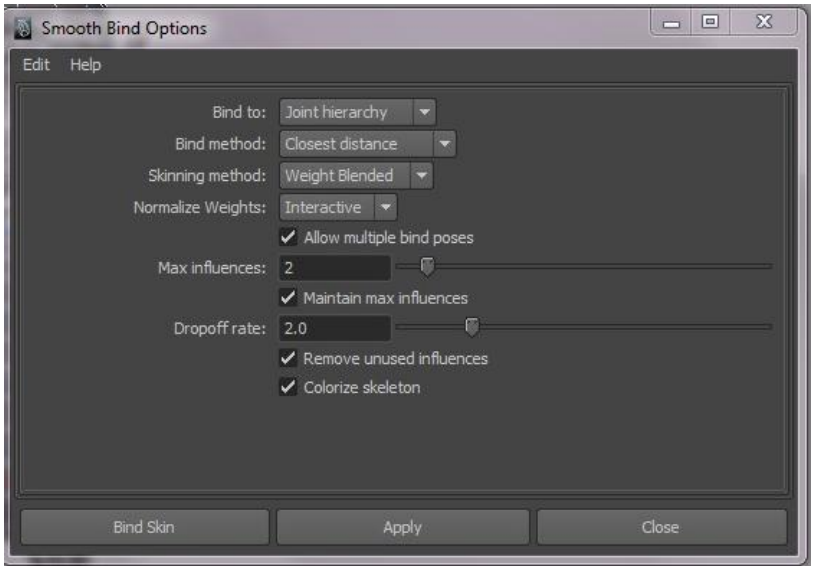


Fig.4. 19. Smooth Bind Options.

2. We can move the controllers to check that the *Skinning* is made. At doing the test, we see that not the whole mesh has adapted well, that's because we need to paint a weight intensity value on the skin, and we do it with the Paint Skin Weights Tool. We select the mesh and go to *Skin* > *Edit Smooth Skin* > *Paint Skin Weights Tool,* we open the options box. Once we have the tool open:
    - We select a type of *Paint operation*, the most used is *Add*.
    - We select a value of influence between 0 and 1.
    - We click on *Use Color Ramp* on *Gradient* options.

- We select one joint on the *Influences* box and we paint on the character's skin. (We can modify the radius of the brush by pressing B and the Left mouse's button)

*The bones of the tip of the head and fingers must have influence 0.

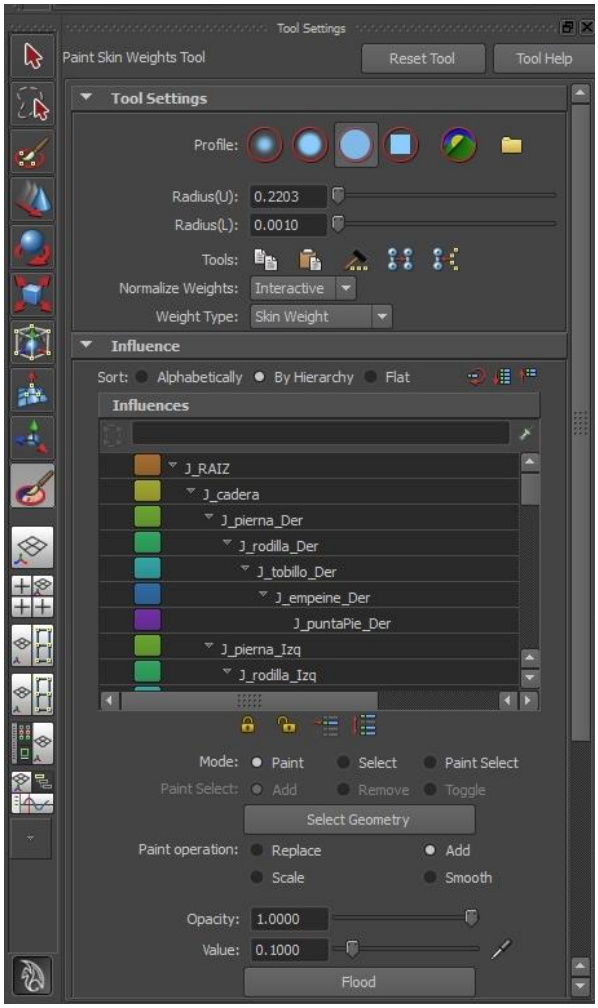


Fig.4. 20. Paint Skin Weights Tool.

3. After painting the influences of all the bones, we make a *Mirror Skin Weights*. We go to *Skin > Edit Smooth Skin > Mirror Skin Weights* and we open the options box to change the settings:
    - Mirror across: *YZ*
    - Direction: click on *Positive to negative (+X to -X).*
    - Surface association: *Closest point on surface*.
    - Influence association 1: *One to One*.
    - Influence association 2: *Closest Joint*.

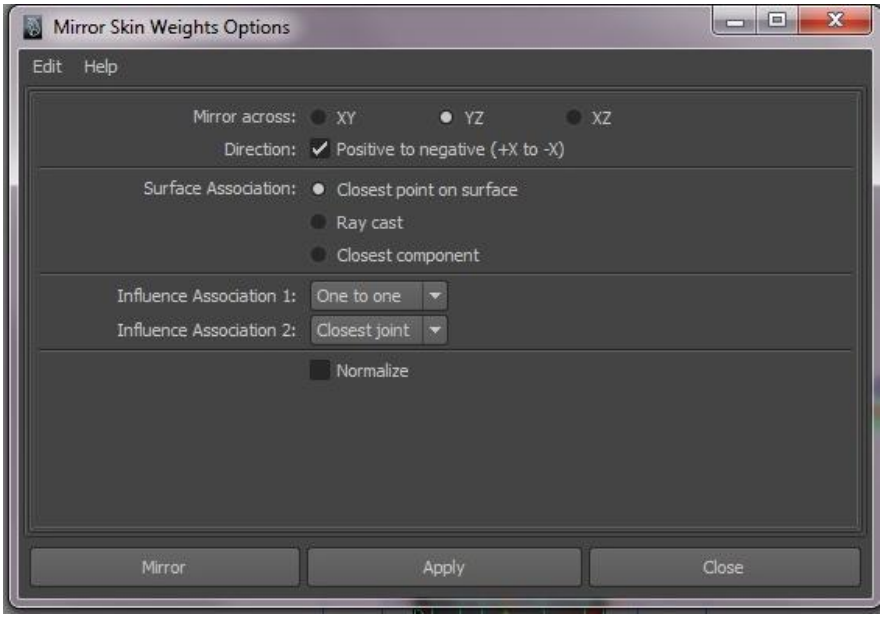


Fig.4. 21. Mirror Skin Weights Options.

5. Lights, materials and textures.

5.1. Lights.

The lighting in my short animation is divided into two: the outdoor spaces and interior spaces.

The **outdoor spaces** are illuminated using the *Physical Sun*. We follow these steps to create the *Physical Sun*:

- We Open the Render Settings, we press the button in the Status Line  , or we go to *Window* > *Rendering Editors* > *Render Settings*.
- We set *Render using* to *Mental Ray*.
  * If the *Mental Ray* option is not shown in the menu of the *Render using*, we go to: *Window* > *Settings/Preferences* > *Plug-in Manager* and make sure the check-boxes for *Mayatomr.mll* are checked.
- We open the *Indirect Lighting* tab and we click the *Create* button for *Physical Sun and Sky*, on the section *Environment*.

Fig.5. 1. Render Settings: Indirect Lighting.

- We rotate the created light to determine the direction of the sun rays.

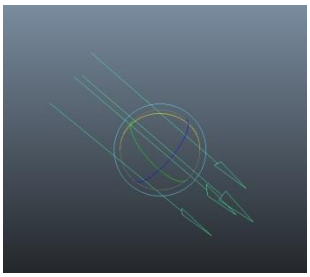


Fig.5. 2. Sun direction.

- The settings for the Physical Sky will open in the attribute editor. We change the settings as the image bellow for the Physical Sky.

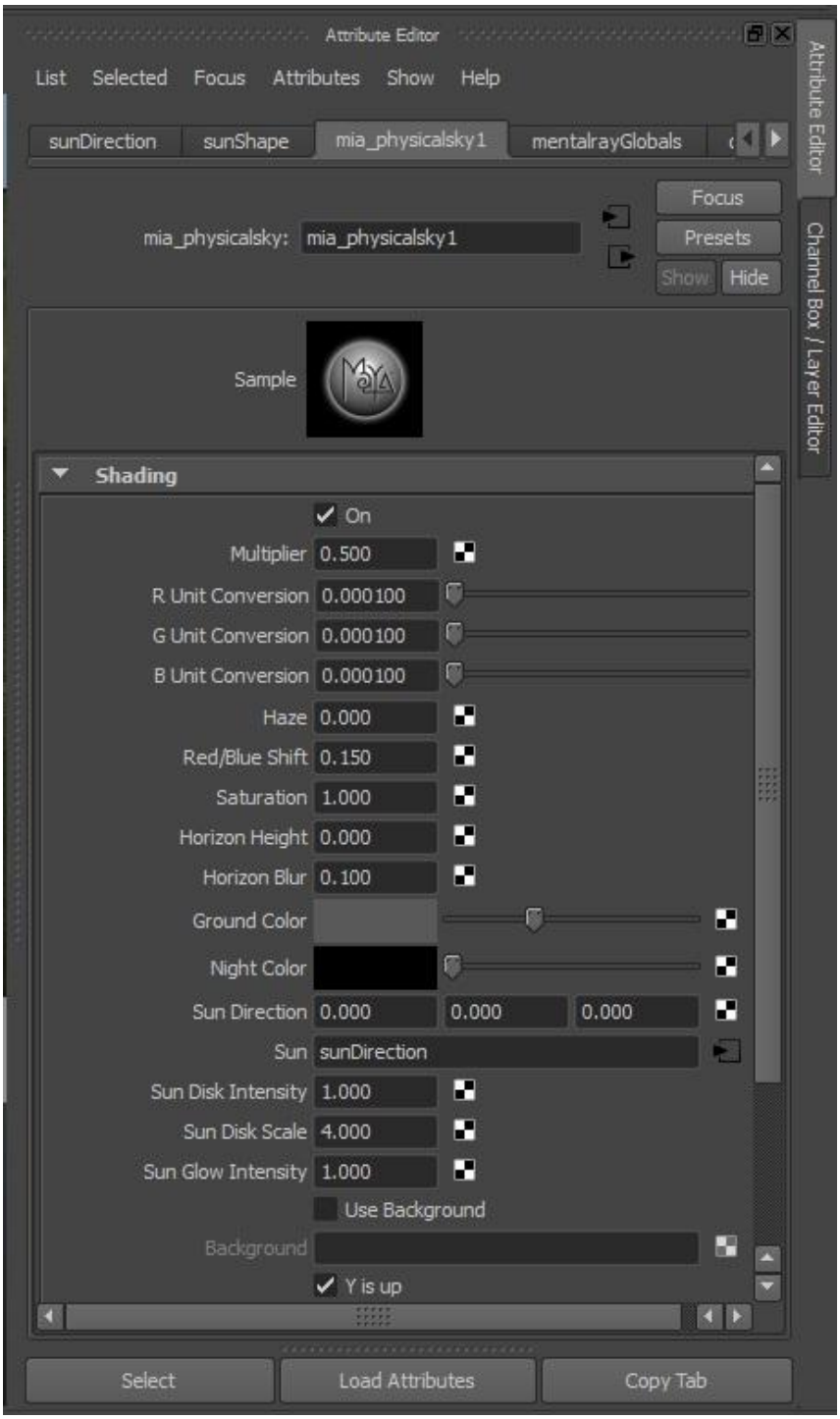


Fig.5. 3. Physical Sky settings.

The **interior spaces** are illuminated using two types of lights: Spot Light and Area Light.

- The *Spot Light* is the type of light that begins in a small point and, as we move away from the origin point, the light expands, it is called cone light. Over a certain

range of the cone, the light is projected uniformly. You can cast shadows. This type of light is used to represent reading lamps, light bulbs, headlights and flashlights.

I have used this type of light to represent the light bulbs on above the bathroom mirror, as you can see in the image bellow.

Fig.5. 4. The bathroom lighting.

The *Spot lights* have some attributes changed such as *Color*, *Intensity*, *Cone Angle*, *Penumbra Angle* and *Dropoff*.

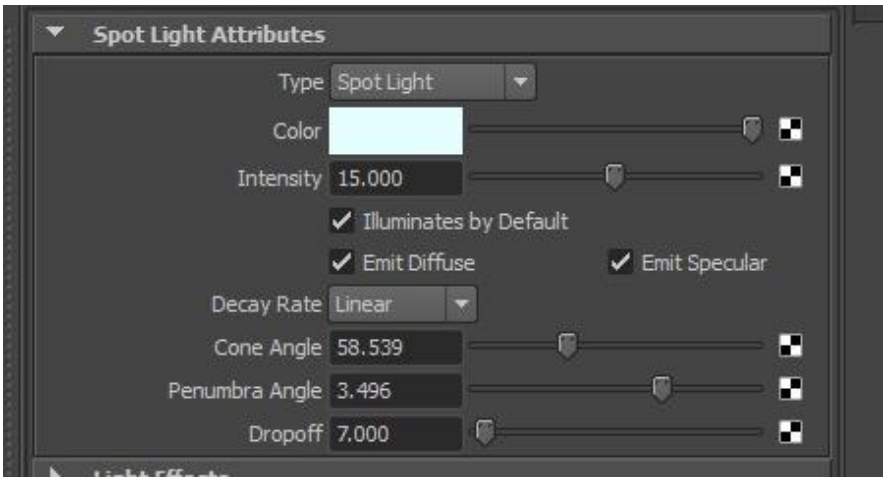


Fig.5. 5. Spot Light Attributes.

- The *Area Light* is a type of light that is emitted from a rectangular defined area. This type of light is quite realistic, incorporating a natural effect of fading and projecting softened shadows. It is used to simulate the rectangular reflections of windows on surfaces.

  I have used this type of light to represent the light of the windows in the living room, and to give more light to the bathroom.

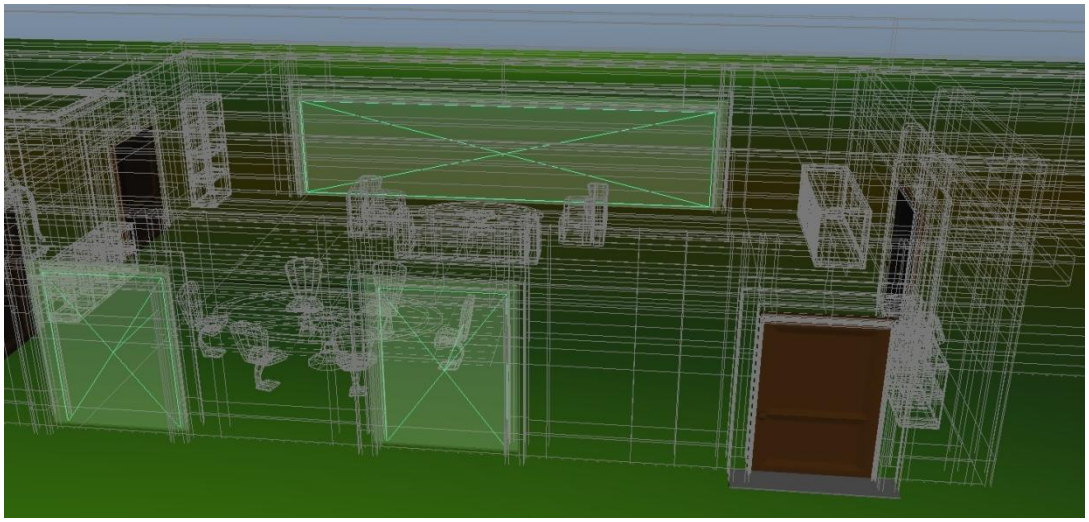


Fig.5. 6. The living room lighting.

I have changed the *Color* and the *Intensity* of the *Area Light*, and I have activated the attribute *Decay Rate*.

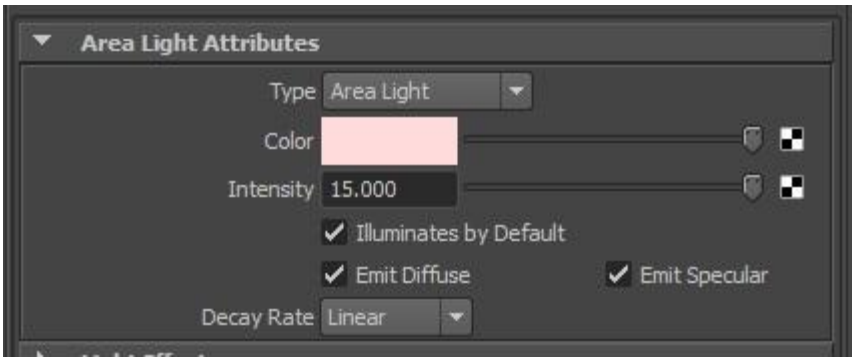


Fig.5. 7. Area Light Attributes.

5.2. Materials and textures.

The materials determine the appearance of an object in our model, these are called *Shaders*. Maya has base shaders such as *Lambert*, *Blinn* and *Phong*, and we can change the properties of the *Shaders* such as color, reflectivity, transparency and others. The *shaders* and *textures* are created with the *Hypershade* (*Windows > Render Editors > Hypershade*) and changing the attributes in the *Attribute Editor*.

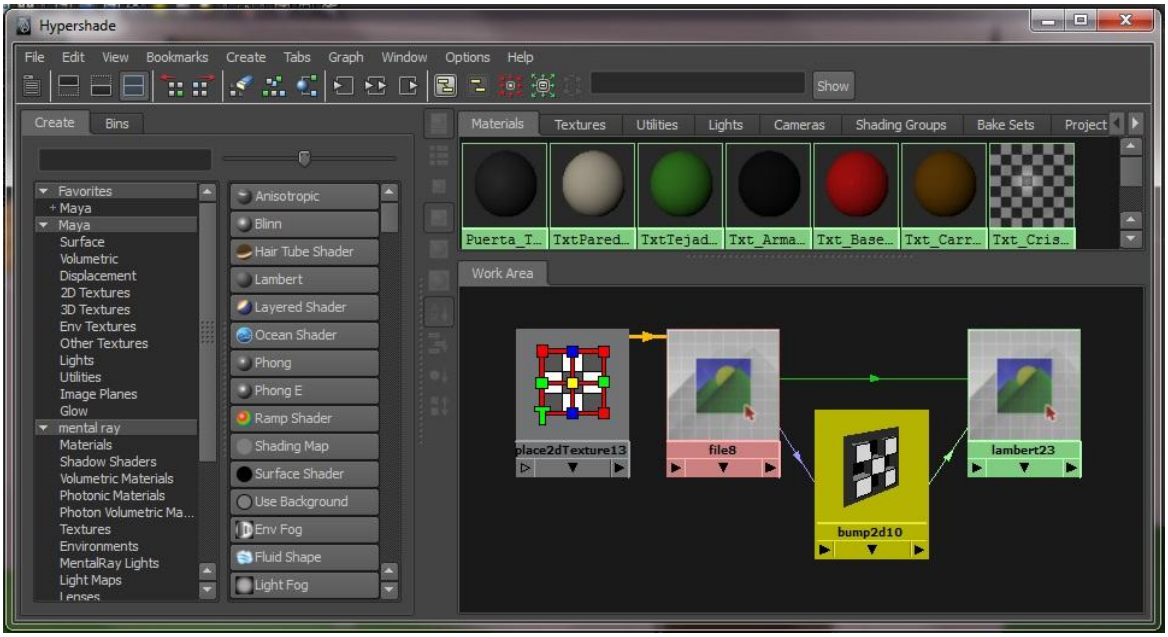


Fig.5. 8. Hypershade.

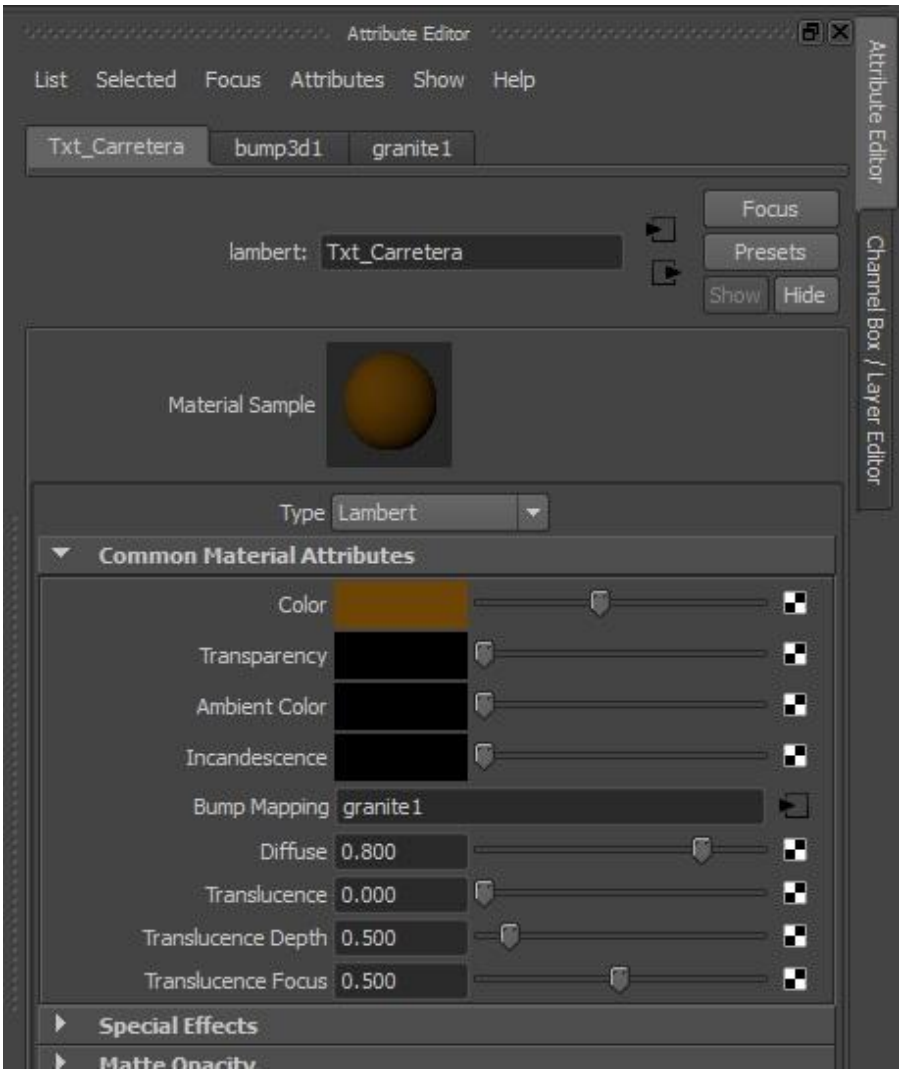


Fig.5. 9. Material Attributes.

All shaders and textures used in the short are described below:

Type: Blinn.

Color: R: 1,000 G: 0,943 B: 0,784

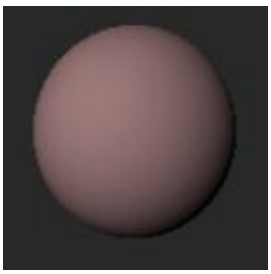
Use: Pearl necklace.

Type: Lambert.

Color: R: 0,745 G: 0,563 B: 0,307

Bump Mapping: Brick texture.

Use: Building's ground floor.



Type: Lambert.

Color: R: 0,765 G: 0,600 B: 0, 600

Use: Mushroom stem.

Type: Lambert.

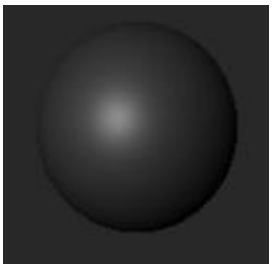
Color: R: 0,699 G: 0,666 B: 0, 590

Use: Walls of the houses.

Type: Lambert.

Color: R: 0,226 G: 0,304 B: 0,608

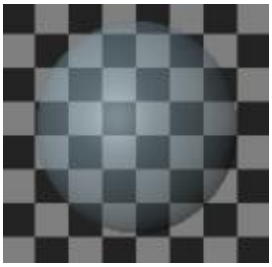
Use: Roof of the house of Txikia.



Type: Blinn.

Color: R: 0,246 G: 0,246 B: 0,246

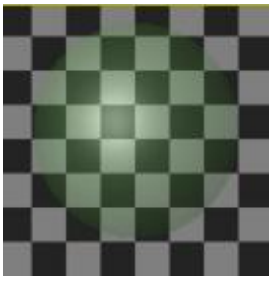
Use: Columns of the building.



Type: Blinn with Transparency.

Color: R: 0,657 G: 0,810 B: 0,882

Use: Windows of the building.



Type: Blinn with Transparency.

Color: R: 0,179 G: 0,415 B: 0,114

Use: Windows of the houses.

Type: Lambert.

Color: R: 0,699 G: 0,666 B: 0, 590

Bump Mapping: Brownian.

Use: Walls of the building.

Type: Lambert.

Color: Brick texture.

Bump Mapping: Brick texture.

Use: Brick wall.

Type: Lambert.

Color: R: 0,168 G: 0,083 B: 0,009

Bump Mapping: Wood texture.

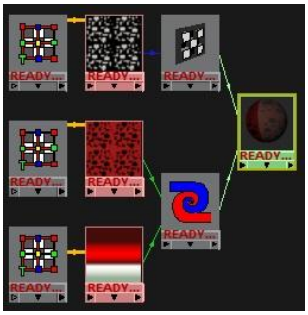
Use: Doors.

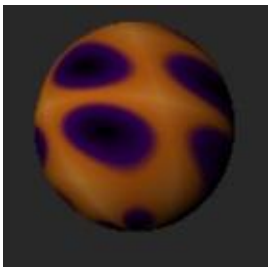
Type: Lambert.

Color: Blend Colors: Polka dots texture and V Ramp.

Bump Mapping: Polka dots texture.

Use: Mushroom 1.

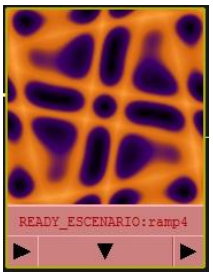




Type: Lambert.

Color: Circular Ramp.

Use: Mushroom 2.

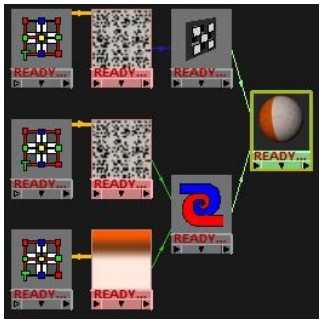


Type: Lambert.

Color: Blend Colors: Polka dots texture and V Ramp.

Bump Mapping: Polka dots texture.

Use: Mushroom 3.



Type: Lambert.

Color: lilac irregular stripes.

Bump Mapping: lilac irregular stripes.

Use: Mushroom 4.

Type: Lambert.

Color: R: 0,558 G: 0,000 B: 0,941

Use: Roof of the house of Tara.

Type: Lambert.

Color: R: 1,000 G: 0,951 B: 0,863

Use: Wooden fence.

Type: mi_metallic_paint.

Color: R: 0,404 G: 0,404 B: 0,404

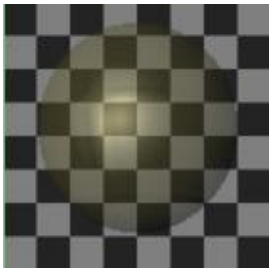
Use: Knobs of the doors and drawers, the legs of tables and chairs, water tap and other metal objects.

Type: Lambert.

Color: R: 0,000 G: 0,000 B: 0,000

Bump Mapping: Leather.

Use: Motorbike seat.

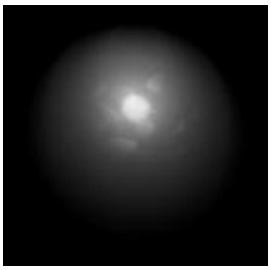


Type: Phong E with Transparency.

Color: R: 0, 504 G: 0, 475 B: 0, 210

Bump Mapping: Grid.

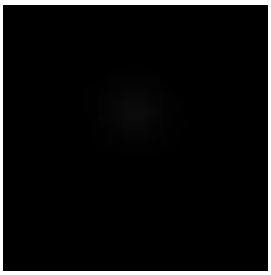
Use: Headlamp of the motorbike.



Type: mi_car_paint_phen_x.

Color: R: 0,341 G: 0,341 B: 0,341

Use: Metal parts of the motorbike.



Type: mi_car_paint_phen.

Color: R: 0,000 G: 0,000 B: 0,000

Use: Black metal parts of the motorbike.

Type: Lambert.

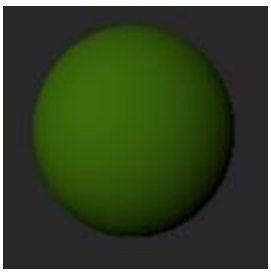
Color: R: 0,342 G: 0,067 B: 0,067

Use: Mouth.

Type: Blinn.

Color: R: 0,852 G: 0,863 B: 0,795

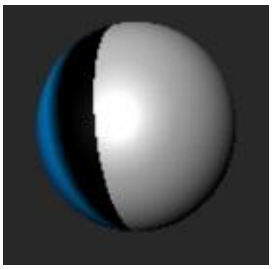
Use: Fangs.



Type: Lambert.

Color: R: 0,299 G: 0,529 B: 0,052

Use: Txikia.



Type: Phong E.

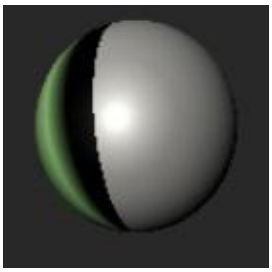
Color: Ramp.

Use: Txikia.

Type: Lambert.

Color: R: 0,309 G: 0,172 B: 0,477

Use: Tara.



Type: Phong E.

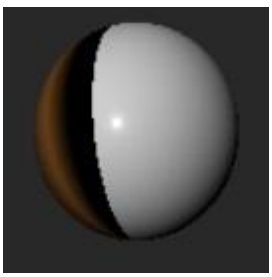
Color: Ramp.

Use: Tara.

Type: Lambert.

Color: R: 0,054 G: 0,095 B: 0,686

Use: Gogor.



Type: Phong E.

Color: Ramp.

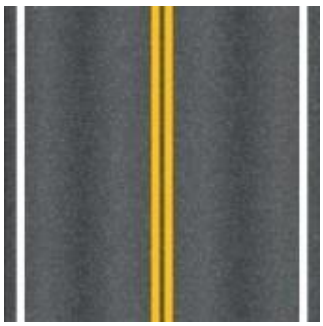
Use: Gogor.

These are the textures made using the UV Mapping and photoshop:

- **Box of chocolates**

- **Photography**

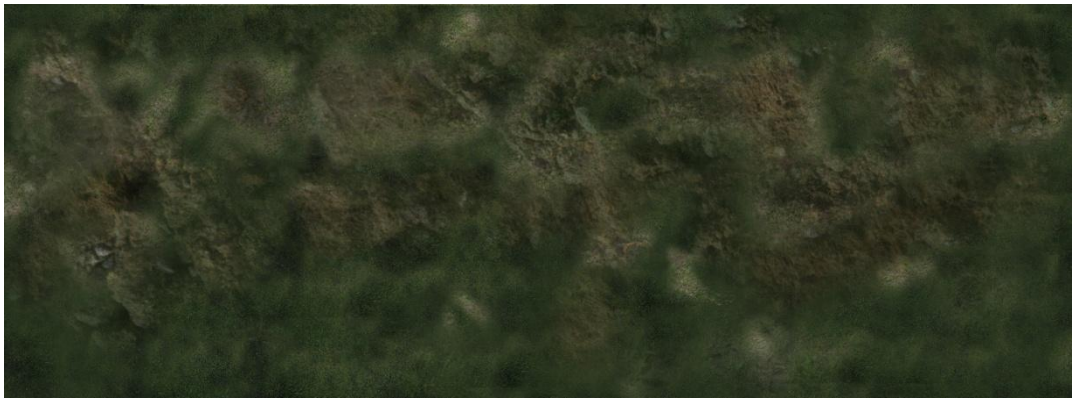
- **Road**



- **Necklace box**

- **Wheel**

- **Mountains**



- **Garden**

6. Animating and rendering.

6.1. Animating.

One of my aims was getting realistic and fluent movements, in order to make the story more credible. One of the things I've done throughout the animation process is to look at the movements of the people and, in many cases, I have represented the scene that I had to animate. I have imitated each pose that I had to animate, so that I could notice the placement of each body part, and which part of the body is moving to do the next move.

Also I have used the *Graph Editor* (*Window* > *Animation Editors* > *Graph Editor*) to get more convincing animation. The *Graph Editor* is an editor that graphically represents the various animated attributes of the selected object. It displays several *animation curves* (*rotation, translation* and *scale*) that we can modify.

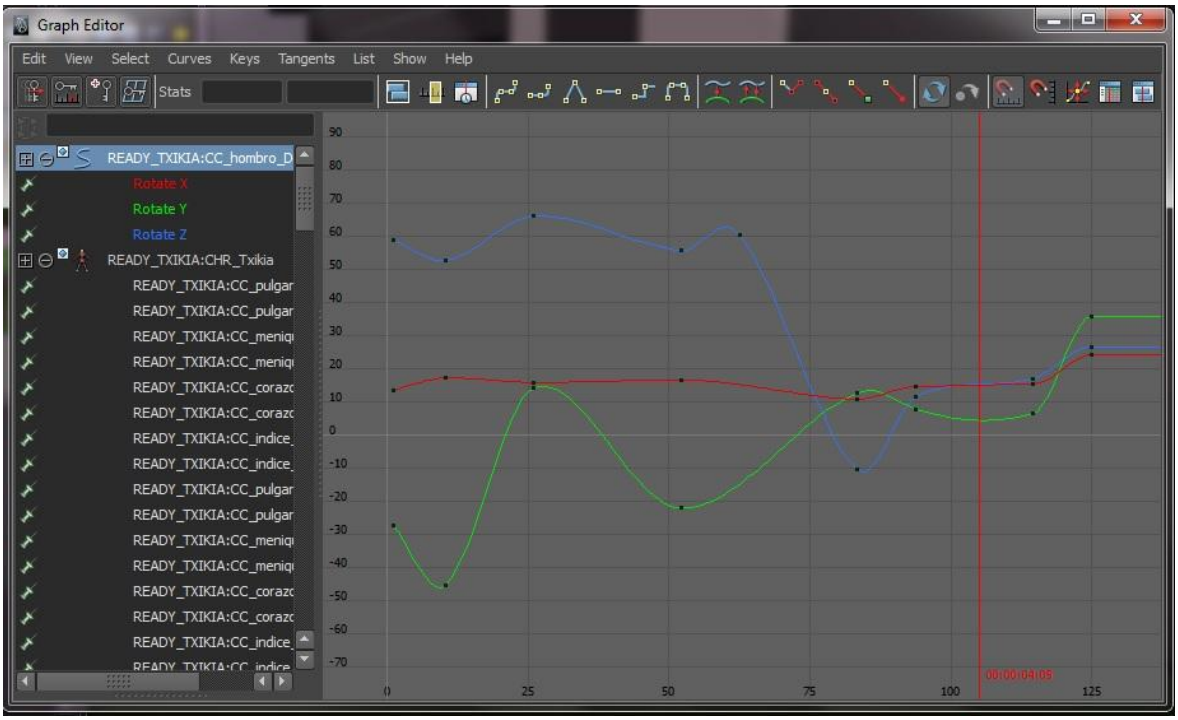


Fig.6. 1. Graph Editor.

I did some tests with the *Graph Editor* by animating a bouncing ball before starting to animate the characters of my animation short.

6.2. Rendering.

I have used *Mental Ray* render engine, and I have activated the *Sun and Sky* system for indirect environment lighting and the *Final Gathering*, which calculates the diffuse light reflections.

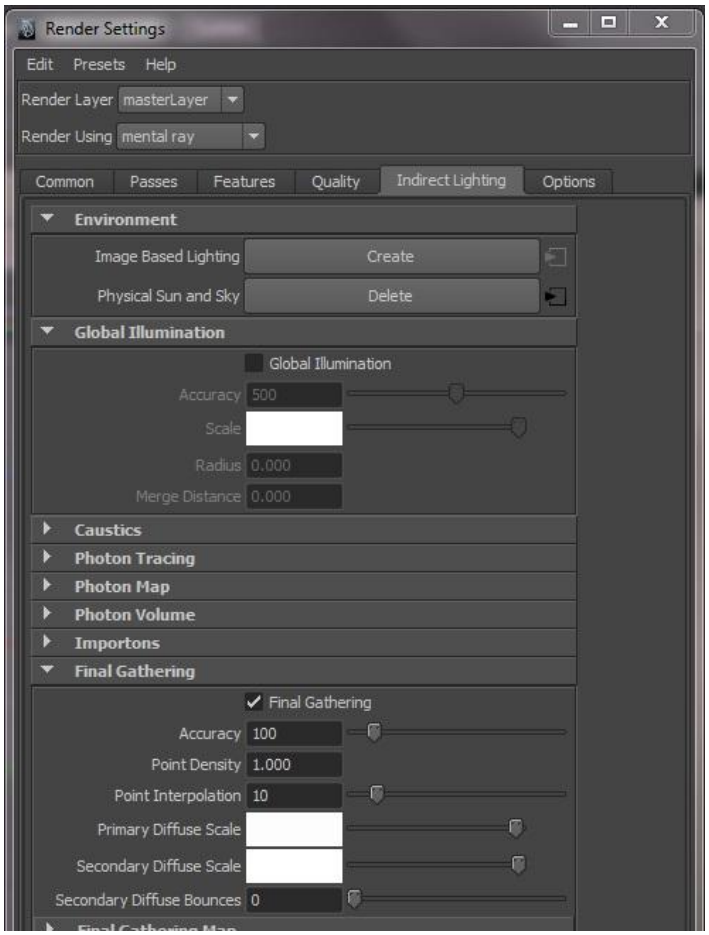


Fig.6. 2. Render Settings: Indirect Lighting.

Render settings:

- **Color management:** Enable.
  - Default Input Profile: sRGB (gamma corrected).
  - Default Out put Profile: Linear.
- **Image format:** PNG (png).
- **Image Size:** HD 720.

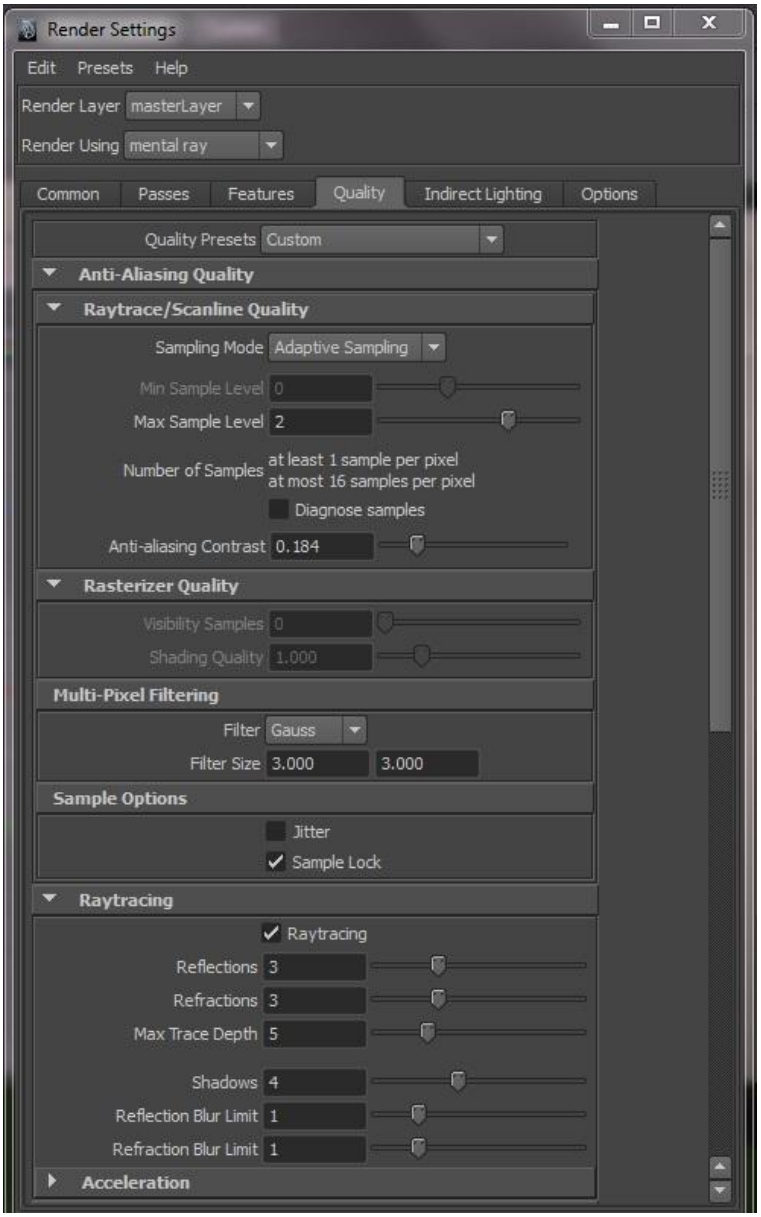


Fig.6. 3. Render Settings: Quality.

7. Postproduction.

Once I had all the scenes rendered, I began the post production that consist in: editing the images I have already rendered, recording the voices, editing the audio and color retouching.

7.1. Video Edit.

The software that I have used in the post production is *Premiere Pro CS6*, which is a video editing program.

- The edition of the images was easy because I made the rendering according to the storyboard, so I did not have to make many cuts in the scenes clips.
- The voice recording was made while watching the animation short, in order to have the voices synchronized at the time to do the edition sound. The voices were performed by:
    - **Aitor Ruiz:** Gogor (The handsome boy).
    - **Sandra Gutierrez:** Tara (The neighbor).
    - **Amaia Sémper:** Txikia (The main character).

- In sound editing I have also used music and sounds of doors, ambients, birds, hits and others, all of them without copyright. I have downloaded them from:
    - **Audionauti X** (www.audionautix.com)
    - **Free SFX** (www.freesfx.co.uk//soundeffects)
    - **Freesound** (www.freesound.org)

7.1. Unforeseen problems.

I had some unexpected problems during the post production that delayed me in the editing process. The animation's classroom did not have any video editing program. I had to wait until the video classroom was free to use the computers there, to see if the program that I wanted to use was avalible. Then, I began the edition from a previous I had made at home. When I wanted to see how it was running well, I realize that the program stopped playing after a second of playback. For that reason, I decided to do the edition in my laptop. Then I

found out it did not have enough RAM to do the render. I had to try different friend's laptops, but the problem was to find the suitable version to do the render, and I found it at the last moment.

6. Conclusions.

I decided to make an animated short because it was a personal challenge. It is known that creating a short on your own is very difficult. I had never before made all the process to create it, so I had to learn nearly all from the beginning.

First of all I had to create a story with a message, in this case was: "If you do not respect the people, someday it will turn against you".

In this document it has been developed all the most important aspects of the creation process of an animated short. I had described in detail the process of: modeling, Set up, rigging, texturing, lighting, animating, rendering and editing.

I am proud with the results obtained because, I have achieved not only make an animated short but a fluidity of movements and very expressive characters, which are the soul of my short animation.

7. References.

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Escola Universitària Politècnica de Mataró

Centre adscrit a:

UNIVERSITAT POLITÈCNICA DE CATALUNYA

Graduat en Mitjans Audiovisuals

TXIKIA

Economic study

AMAIA SÉMPER GONZÁLEZ
PONENT: DAVID MINGUILLÓN

SUMMER 2013

TecnoCampus Mataró-Maresme

Index.

1. Budget.

1.1. Material cost.

Description	**Price per unit (€)**	**Total**
PC-HP Pavilion Elite HPE	1.421,9 6	**1.421,9 6**
Monitor acer	95,96	**95,96**
Office material	50	**50**
Others	100	**100**
TOTAL MATERIAL COST		**3335, 84**
TOTAL MATERIAL COST WITHOUT AMORTIZATION		**2.082,08**

1.2. Human resources.

If the project had been carried out with professionals have needed: a writer of the script, a modeller, an animator, video editor and audio editor.

Concept	**Hour**	**Price/hour (€)**	**Total (€)**
Writer of the script	45	25	**1.125**
Modeller	100	30	**3.000**
Animator	30	30	**900**
Video Editor	10	25	**250**
Audio Editor	20	25	**500**
TOTAL HUMAN RESOURCES			**5.775**

1.3. Equipment and software.

One of the things that we have to do in the economic study is to calculate the lifespan of our equipments and software, in order to know if they are profitable for our project.

Equipement and softward	**Price**	**N (years)**	**Euros/year**
PC-HP Pavilion Elite HPE	1.421,96	5	**284,39**
Monitor acer	95,96	8	**12**
Autodesk Maya	3.900	4	**975**
Adobe Premiere Pro	299,4/year	1	**299,4**
		TOTAL YEAR AMORTIZATIONS	**1.570,79**

1.4. Total project cost.

Material cost	2.082,08 €
Human sources cost	5.775 €
Equipment and software	1.570,79 €
TOTAL	**9.427,87 €**

Escola Universitària Politècnica de Mataró

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UNIVERSITAT POLITÈCNICA DE CATALUNYA

Graduat en Mitjans Audiovisuals

TXIKIA

Annex

AMAIA SÉMPER GONZÁLEZ
PONENT: DAVID MINGUILLÓN

SUMMER 2013

TecnoCampus Mataró-Maresme

GLYNDWR UNIVERSITY

THE EFFECTS OF THE ARRIVAL OF 3D IN THE 12 PRINCIPLES OF ANIMATION

DISSERTATION

Amaia Sémper González

INDEX

1. INTRODUCTION

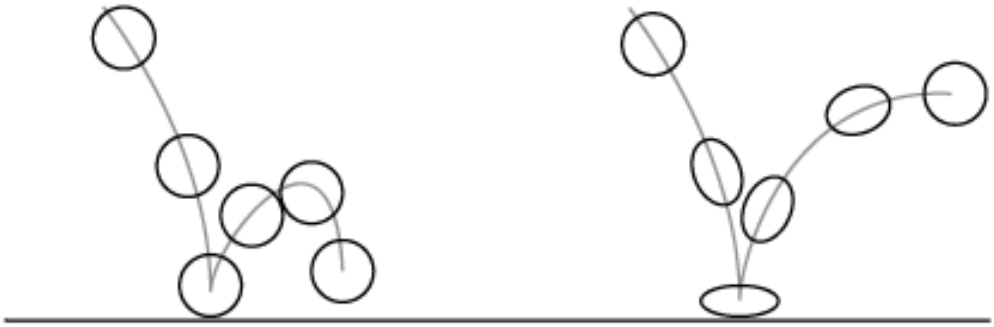
The Twelve Principles of Animation were introduced by Ollie Johnston and Frank Thomas in their book The Illusion of Life: Disney Animation in 1981. Both were animators in Walt Disney Studios and they based these principles in the work of the animators from the 1930s and their effort to produce more realistic animations. These principles helped to consider the animation as a way of art, and were initially applied to animated movies that now are classics, like Snow White (1937), Pinocchio and Fantasia (1940), Dumbo (1941), and Bambi (1942).

On the one hand, the aim of the principles is to guide the production, creative discussions, the action, and the representation of the reality by applying real world physics. On the other hand, it is also important to advise about other aspects, such as helping to create emotional moments and engaging characters.

2. THE ORIGINAL 12 PRINCIPLES OF ANIMATION

2.1. Squash and stretch

This is one of the most important principles, the intention of which is to represent the rigidity and mass of the bodies during an action. What they do is to deform the objects by applying the laws of physics, for example, if you drop a ball, when it hits the ground it flattens somewhat because of its weight, and after that, it recovers its original shape. Moreover, we also use deformations in an exaggerated way to better understand the action, or simply to achieve a more comic or dramatic effect.



Bouncing ball.

In an animation movie, we just have the information that give us our eyes, I mean that we cannot touch the bodies that we see in the movie. So that the audience better understand the action and the characters, it is important to take in count the rigidity and the mass of the bodies that we show. Squash and stretch defines the rigidity of the material making up an object. When an object is squashed and stretches out in an exaggerated way, it gives the sense that the object is made of a soft, flexible material and vice versa. When the parts of an object are made of different materials, they should respond differently.

Most of the inorganic objects of the real world are rigid like furniture [2]; however the organic objects have some level of flexibility in their shape. This principle is which gives flexibility to the body, squash or stretch a body does not mean that the body increases or decreases its volume, but it remains constant.

2.2. Anticipation

An action occurs in three parts: the preparation for the action, the action itself, and the termination of the action. *Anticipation* is the preparation for the action. [2]

Anticipation is used for several purposes. One of them is to strength the credibility of the action, that is to say, make the actions more natural doing a movement in the opposite direction to the action, for example if someone is going to kick a ball with the foot, it must be pulled back to hit the ball harder.

Oliver is doing the anticipation to kick the ball. Oliver and Benji.

Anticipation is also used to direct the attention of the audience to one side of the screen in the right moment. It is important to prepare them for an action that is going to happen, so that the audience not miss anything. Anticipation is often used to explain what the following action is going to be. Before an angry character closes the door, firstly he opens it slowly, letting the public know that he will close it abruptly.

The duration of the anticipation affects the speed of the action that follows it. If the audience is awaiting an action, anticipation can be faster. But if the public does not expect anything to happen, the anticipation must be longer or the action slower. The anticipation is related to the level of surprise and suspense; if it is large, you will get more suspense, but less surprise, and vice versa.

2.3. Staging

This is one of the most important principles because it covers different areas. Staging is the organization of the elements in the scene to present an idea clearly. When I say idea, I am referring to an action, an expression or a feeling.

To submit an idea, it is necessary that the audience is watching the main action at the right time. We are the ones who have to guide the public eye. It is important to present just one idea, otherwise, if several actions happen simultaneously, the audience may be lost and the main idea can be overlooked. We should not add elements at the scene because they are cute or funny. Instead, we have to think that the elements of the scene are part of the idea and they have to help the audience to understand what is happening.

In the staging, it is important to have in count the angle and the distance of the camera relative to the idea. For example, if the main action is an expression, we must do a close shot.

2.4. Straight ahead action and pose to pose

There are two different techniques to animate. One of them is called Straight Ahead Action, because the animator works straight ahead from his first drawing in the scene. He simply does one drawing after the other, getting new ideas as he goes along, until he finishes the scene. This

technique helps the action to get a fresh, slightly zany look, owing to the fact that the whole process is very creative.

Straight Ahead Action is used in high-action scenes, such as fights, where spontaneity is important.

The other animation's technique is called Pose To Pose. Here, the animator has to plan his actions to know what drawings are going to be needed to animate the scene. Firstly, they make the drawings of the key poses, relating them to each other in size and action, and after that, are made the in-betweens. With Pose To Pose, there is clarity and strength.

The two methods are still used, is chosen one or another depending on what requires action.

2.5. Follow through and overlapping action

"Just as the anticipation is the preparation of an action, follow through and overlapping action is the termination of an action and establishing its relationship to the next action" as noted by Frank Thomas and Ollie Johnson. [1]

The actions hardly ever stop suddenly, but are generally carried past their termination point. For example, when someone kicks a ball, his leg does not stop suddenly after the hit, instead, the inertia makes the leg continues after the point of release until he slows totally.

An action neither should finish abruptly nor come to a completely stop before starting another action, and the second action has to overlap the first.

Overlapping maintains a continual flow and continuity between whole phrases of actions. [3]

2.6. Slow in and slow out

Slow in and Slow out deals with the spacing of the in-between drawings between the extreme poses.

Usually, the elements need an acceleration to achieve a constant or a maximum velocity, and a deceleration to stop. It is rare for something to moves from the start to the end at a constant speed; that is because there are factors that influence the movement of bodies, like for example, gravity.

For example, if we drop a ball, it accelerates as it falls; the force that pushes the ball to the ground is gravity. When the ball hits the ground, it loses speed, but as it moves away from the ground, the ball, gets speed.

Slow in and Slow out helps us to get more natural movements.

2.7. Arcs

When we use arcs to animate the movements of a character, we are providing the character a more natural look, is because the most part of the living being moves in curve paths, never in perfect straight lines. Usually the arcs are used to guide, in order to get more fluid movements.

To achieve a more natural look, we have to use arcs instead of straight lines, if not the animation's appearance will be mechanical, robotically or sinister. It is rare that a character or a part of him is moved in straight path. When we throw something, the arm makes a curvilinear path; or when a rabbit runs, the trajectory of his jumps will be also arched.

Wile E. Coyote and Road Runer.

2.8. Secondary action

Sometimes, an action, or an idea, being put over a scene can be seen poor or simple, that is why is important the role of the secondary action, which is the result of the movement of another action. This has to be used as a support or complement to the main action, but never should distract the audience. The role of the secondary action is to strengthen the main idea.

For example, if someone is running, as a result of his movement, his hair also is going to move; or if a character extends his arm to grab something, his eyes will also move toward the object.

The facial expressions of a character can also be secondary actions. When the main idea of the action is being told with the body, facials expressions become subordinated to the main idea. If we want to change a facial expression, we have to do it before or after the main action, because if we do it in the middle of an action, the expression can be overlooked. It must also be staged to be obvious, though secondary.

Secondary action provides interest, attractive and realism to the character, and therefore to the animation. [1]

2.9. Timing

Timing, or speed of an action, is the time that an action takes to develop. This principle can seem very basic, but is one of the most important things that we have to take in count at the time to animate. The time must always be present in every step we take. Timing not only defines the time it takes to perform an action, but also help us to reveal to the audience the weight and size of a character or an object that is animated, and can even carry emotional meaning.

On the one hand, the Timing influences the appearance of weight that has an animated object. Two objects with identical size and shape can appear to be two different weights by changing his timing. A heavy body is slower and need more force to accelerate or decelerate than a lighter one. Light objects are easier to change their movements and need less time to start moving.

On the other hand, timing can also contribute in the sensation of scale or size of an object or character. A giant will have much more weight than a tiny character, and because of that, he will move slower, as we noted above.

Ultimately, timing plays a very important role at the time to represent the emotions of a character. The velocity at which a character performs an action can reveal your mood, if nervous, quiet or tired. For example, if someone blinks fast, he will seem alert and awake. If he blinks slowly, he will seem bored and tired.

2.10. Exaggeration

The aim of this principle is emphasize certain actions that can be important to tell our story. The animator has to find the essence of each idea, understand it and know what he wants to transmit, in that way, the animator will make the audience to believe and get excited for the story.

It is about bringing an action to the extreme. If a character is sad, make him seem sadder; if he is angry, make him furious; and if he is happy, make him jump for joy. Nor should we fall into the trap of exaggerating arbitrarily without thinking about why we do it, or worse, exaggerate everything in the scene; because the animation will go from be realistic to be violent or not credible.

The exaggeration can be applied to any element of the scene: design, shape of the objects or characters, action, pose, emotion, colour and even sound; but should not be used in isolation, nor apply exaggeration to all the elements of the scene.

2.11. Solid drawing

Learn to draw is important because you have to know how to draw every character in all possible positions and from all angles to achieve a good production. As Grim Natwick said “You should learn to draw as well as possible before starting to animate”. The more the animator learns to draw, the more solid his drawing will be. Therefore his characters will be able to get more possibilities of movement and action, achieving an original product. As Marc Davis said “Drawing is giving a performance; an artist is an actor who is not limited by his body, only by his ability and, perhaps, experience”.

To achieve a solid drawing we should have in count the weight, the structure, the perspective and the proportions, the balance and, the lights and shadows of the objects and the characters. When we are animating we should have a character with a strong and consistent structure, because if we turn the body of the character to one side, his parts such as eyes, mouth, arms, legs, and head have to remain in place without losing coherence.

We always should have activated the sense of perspective, so that objects that are further away from the camera have to be proportionately smaller than those that are closer.

Although our animation is going to be two dimensions, we have to think that the world we are creating is in three dimensions, and therefore the characters have depth, weight and balance.

2.12. Appeal

If we want to excite the public with our animation, we must not only do an original and interesting story, but we must also create characters equally original and interesting.

The appearance of a character must be seductive, with appealing, and be nice to our eyes whether as much he is a villain as an angel. They must have charm and transmit something to the audience. They should have independent personalities; two or more characters should not react in the same manner, unless this feature plays an important role in the story. To avoid creating two identical characters, we should create a story for every one of the characters. We should know where they come from, what they have done in life, how they relate to other characters, which are their needs, interests and desires, and where they want to go. This way we will know how they will react to different situations that arise and without being out of place. The animator must know well the story of a character before start to animate. Is also important to know the character's mood at all time, considering that a character will react or move differently depending on how they feel. If a character is sad or tired, he will walk slower than if he is happy or nervous.

In this principle we have to apply the knowledge of all the principles that we have seen previously, because we can create an incredible character but if we do not know how to move it, it will have been a waste of time. To achieve an appealing character, we must remember to use arcs, avoid the symmetry and stiffness, use exaggeration and secondary action, among others.

In summary, it's about making a character come to life and to give him a personality according to their actions, and try to establish an emotional connection with the audience.

3. FROM 2D TO 3D

Traditional animation or two dimensional is an art form that became popular in the 19th century with the creation of the zoetrope, which is a device that produces the illusion of motion from a rapid succession of static pictures; and the flipbook, that is a book with a series of pictures that vary gradually frame one page to the next, so that when the pages are turned rapidly, the pictures appear to animate by simulating motion. Shortly after, the first animations were done, frame by frame was drawn by hand, until it developed a system that reduced much of the work of the animators, the celluloid, a transparent plastic in which can draw and color. This system was used to reduce the large number of static backgrounds, 24 drawings for second were reduced to one. Since 1920, the animation techniques began to change and evolve in order to improve the development and realism of the animations. The rotoscope was an invention that helped convey the naturalness and sequential pattern of movements, expressions, lights, shadows and proportions typical of real life. The advancement of technology has enabled the emergence of three-dimensional animation. Although 2D and 3D are animations, the capabilities of each one and the process to create them, differ greatly.

- The process of creating animations in 3D can only be done with a computer with software such as 3D Studio Max or Maya. Although 2D animation can also be created in a computer using programs such as Adobe Flash, or can also be done using individual pictures on each page to simulate movement.

- The 2D animation objects can only move horizontally, in x axis, for simulating movement forward and backward, and vertical, in y axis, for movements upwards and downwards. In 3D animations, objects can also be moved closer or farther from the person, that is viewing the animation, along the z axis. If you want an object appear closer to the camera in 3D animation, it has to be moved closer through the z axis, but in 2D animation in return the object should be drawn larger to create this effect.

- The characters and scenarios in 2D animation have a flat surface, as in a painting or photograph, you can only see the front because it is the only part that exists in the animation. The sense of depth in the 2D is achieved from the perspective, colour, shadows and volumes of things. Instead, in 3D you don't have to draw every photogram to see the object from another angle. What we do is to build in three-dimensional, modelling every object, character or scene that appears in the movie. It is only need to create each element once. Objects are as sculptures, having front, back, top and bottom, therefore they can be seen from any angle.

- 3D animation programs have virtual cameras as part of the animation process. This camera has many functions, including focal length. The camera moves like a real camera, including zooms, pans and travelling shots. In 2D we do not have this technology, the movements must be made through drawing.

- The 3D animation programs have lights that can simulate virtual spotlights, bulbs or even the sun. The virtual lights have several settings as graduate the intensity of light, change the colour and several options for creating a greatly variety of special effects.

Objects that pass in front of these lights project realistic shadows on other objects in the scene. Instead, in 2D animation, shadows and lights should be drawn by hand.

- The 3D animation through the use of 3D models and realistic textures, you can create images that are virtually indistinguishable from real life. Even the highest quality 2D, still looks as a hand-drawn cartoon.

- 3D animation has a process called motion capture, used to make the animation process easier. This involves an actor wearing a special suit with dozens of points in it. As the actor moves, the camera uses these points as reference to animate the 3D character. These points can be used also in the actor's face to capture facial expressions and mouth movements for the talks. The 2D animation does not has motion capture but does have a similar process called rotoscope, in which is drawn the characters, frame by frame, over a live-action video, this helps the movements to be more credible and fluids.

- Finally there is the issue of the special effects. In 2D animation, effects like fire, smoke, water movement and explosions, have to be drawn carefully frame by frame by hand. But in 3D, these effects are generated with plug-ins, which generate the effect automatically after setting some parameters.

As we have seen, with the emergence of 3d animation, the animator has full control of the space, the movement of the object and character, the time and the filming

4. THE NEW PRINCIPLES

The 3D has not changed the traditional animation principles but how to apply them.

- Squash and stretch: We may use various techniques such as skin and muscle or direct mesh manipulation. On the other hand, we also have dynamic simulations and IK systems.
- Anticipation: We can increase or decrease it, including motion holds or using digital time editing tools.
- Staging: A handy tool for previewing the staging is 3D Animatics.
- Straight ahead action and pose to pose: It makes use of channels and layers to mix different types of motion as motion capture and dynamic simulations.
- Follow through and overlapping action: There are dynamic simulations to animate most of the follow through such as clothes and hair.
- Slow in and slow out: In 3D programs we have digital time editing to facilitate speed changes. If we use motion capture, we have to tell the actors to do slow in and slow out.
- Arcs: We can use software constrains to force all or some motion within arcs.
- Secondary action: Channels and layers are used to have a control of many of the secondary movements.
- Timing: We can refine timing with non-linear time editing tools to shave-off or add frames.
- Exaggeration: We can use the techniques used in Squash and stretch. Furthermore, the cinematography and editing also help us to increase the emotional intensity.
- Solid drawing: in 3D animation is called Modelling. We should take advantage of modelling to develop visual style. [2]

4.1. Visual styling

In 3D animation, when we talk about visual styling, we mean something else besides the mere appearance of the things. When we produce an audiovisual piece in 3D, we have to take into account each level of the production, the modelling, the texturing, the animation, the illumination and the render.

The animation's production process is like a net, everything is connected, if you modify one part, this will produce a change in another. If you modify the shape of an object, the texture, which we have applied to it, will change in aspect. Also, the lighting of each scene influences the look of each texture in the render. Therefore we have to think about every detail, because one little thing can complicate the production process. For example, if our character is a lion, we

can apply a texture with fur imitation, or we have the possibility of creating a more realistic lion by adding fur. Everything depends on the result you want to achieve or style we want to create, and the time that we have to carry this out, because it takes much longer to render a character with fur.

Therefore, it is important to make a good planning of the production process, think of what visual style we want to achieve, and the level of complexity that it will have.

4.2. Blend motion

The technology has advanced greatly in recent years, there are new tools and new techniques such as dynamic simulators, curves-editors, time-editors and motion capture. Nowadays it is possible to blend motion from different sources, and we need to develop a clear approach for blending cartoon with realistic motion. [2]

With the new animation techniques, it is possible to make more realistic productions. Sometimes, when we see a movie, it is difficult to differentiate the scenes, characters or real landscapes, of which are made by computer. It is important to think about what level of reality do we want to create and it is necessary to define clear guidelines for a variety of motion or animation styles including cartoon physics, realistic cartoon, realistic human motion and rotoscoping.

4.3. Cinematography

3D computer animations give us absolute control over camera positions and movements, and this has a huge impact on animation layout and the overall productions process. It is crucial to consider this point as one of the most important, because stories are explained through the lens. The diversity of shots helps the animation to be more dynamic, entertaining and transmit the ideas better to the public. It is necessary to have knowledge about camera techniques and how are they used. The following are the camera elements in any scene:

- Camera shots: The use of different shot sizes is very important in shaping meaning in a film. Camera shots are used to show different aspects of a landscape and characters. The size of the subject in frame depends on two things: the distance the camera is away from the subject and the focal length of the camera lens. Common shot sizes: Extreme close-up, close-up, medium shot, long shot and extreme long shot.

- Camera angles: It is important to not confuse camera angles and camera shots. Camera angles are used to position the viewer, so that the audience can understand the relationships between the characters. Eye Level is the most commonly used camera angle in film and television because creates a sense of normality and realism, because this is how we see the world. Other camera angles are: overshot, high angle, low angle and undershot.

- Camera movement: It helps us give the almost physical sensation of entering in the images and 'travelling' with them. Using a virtual camera you can make almost any

move, however, it is still a good idea to use these real world moves. There are two types of camera movements.

One type is the physical movement that includes panning and tilting, travelling and rotation. Panning, tilting and travelling can be done with camera in hand or, with travel, handycam, steadicam or crane, among others.

The other type is the optical movement like zoom and depth of field. On the one hand, the zoom can be used to do camera movements without moving the camera, because a zoom lens has a variable focal length. On the other hand, the camera have a depth of field, that is to say, only part of the image is in focus, therefore, is used to direct attention to one side or another in a scene. Using a virtual camera you can make almost any move, however, it is still a good idea to use these real world moves.

Besides positions and movements of camera, it is important to treat lighting with special attention, because it has a huge impact on the system and render finish. Lighting work contributes as well to the emotional response that the audience has while see moving images. Lighting in a film is created depending on the mood and atmosphere of each scene, for example, in a scary movie, the scenes will be dark and full of shadows to create tension, mystery or scary.

4.4. Facial animation

As we know most of the animation principles are important at the time of transmit to the audience an idea or feeling. The same as the real actors have expressions, the animation characters should also have them. The facial animation is one of the things that give life and increase the virtual character's believability, since most of thoughts and emotions are expressed through the facial and eye movement.

Even though we have a good story, illumination, cinematography, visual styling, among others, if we do not give life to the characters through their facial expressions, the animation could result poor or the message that we want to transmit could not be understood. It is important to emphasise the expressions and reactions of the characters, so that the public can be touched and come to understand how is feeling a character at a given time.

Nowadays 3D computer animation offers more facial animation control than ever before, including the subtle motion of eyelids and eyeballs, so we have to use it to get more successful productions. It is important to determinate early in the process, the level of facial control and techniques to be used, so that the characters will have the same style. During production we should start making a catalogue of facial morph targets and blend shapes for production and reuse, it is as important as building the animation essential cycles like walk.

In facial animation there are several different ways of animating. The three primary techniques to animate the face are:

- Bone Animation / Skeletal Animation
- Muscle Simulation
- Blend Shapes / Morph Targets / Shape Interpolation.

5. CONCLUSIONS

The advent of 3D has changed the thinking of the animators, as it has introduced variety of techniques and elements that did not exist in the process of creating an animation in two dimensions. The process of creating and animating a three-dimensional character differs widely of the process used in 2D animation.

In 2D animation, a character is created by drawing; however, in 3D consist in modeling the objects individually. Once the elements are been modeled, we can do the texturing, but before this, we must think about the visual style that we want to get in our animation. It is important to plan well the whole process of creation before start to create, and therefore, to not have any fault arises in the rendering and finishing.

In 3D, there are several techniques that help us to create more natural and believable movements, such as motion capture, dynamic simulations and time editors. The 3D software allows us to generate all kinds of shapes, apply textures, light up the scene and move any items, whether an actor, a light or a camera. Since there is such a big step from the way we do and create a three dimensional animation of a two dimensional, it have had to reinterpret and add new principles covering all these changes and, thus, to guide the animators in the new world of animation.

The animation serves to give free rein to our imagination, creating stories and altering reality to create dreams. The reinterpretation of the principles of animation helps us make our creations more credible, and improve the communication, expression and storytelling of our animation, increasing its value and enjoyment of it.

We can say that plan and direct an animation using traditional and modern principles will make us more effective.

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