

Jan. 25 | *Story of a Girl*

Thesis submitted to the faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

Master of Fine Arts in Creative Technologies

Keywords: Short Film, Animation

Professor Thomas Tucker, Chair

Professor Dane Webster, Member

Professor Carol Burch-Brown, Member

Hadeel M. Ramadan

December 8, 2014

Blacksburg, VA



Abstract

The work presented in this thesis explores the possibility to integrate two dimensional drawings with three dimensional animated characters in 3D computer graphics. The goal was to preserve the effects of the cartoonish artistic style and produce a strong emotional and moving story without realistic animation feel.

Inspiration of the storyboard was based on a true story from the Arab Spring events that occurred in several Arab countries, I focused my work on the context of Egypt.



Acknowledgments

I cannot express enough thanks to my committee chair Professor Thomas Tucker for his continued support, encouragement and patience. I offer my sincere appreciation for my committee members, professor Dane Webster and professor Carol Burch-Brown for their constructive comments, guidance and suggestions.

A special thanks goes to my family. Words can't express how grateful I am to my mother, my father, my sister and my brother for all of the sacrifices that they have made for me. Your prayers were what sustained me thus far. I would also like to thank all my friends who supported me to strive towards my goal.

To my little mercy and my light of my life, thank you for allowing me time away from you to achieve this part of my dreams.

Finally my deepest gratitude goes to my loving, caring, and supporting husband, Dr. Ahmed K. Ali. Your encouragement when times were rough are much appreciated and duly noted. My heart is full of thanks.

Contents

Abstract	ii
Acknowledgements	iii
List of Figures	v
Introduction	1
Storyboard and Characters	2
Modeling and Sculpting	6
Texturing	9
Rigging and Animation	11
Lighting and Rendering	16
2.5D Effect	19
Editing and Compositing	23
Conclusion	25
References	26

List of Figures

Figure 1- Hand drawing the man in black design	3
Figure 2- Hand drawing the main character design	4
Figure 3a- Scene 4 before and after adding the details	5
Figure 3b- Scene 1 before and after adding layers of light in photoshop	5
Figure 4- Orthographic Views during model construction	7
Figure 5a- Main Character stages	8
Figure 5b- Wireframe and Shaded Display	8
Figure 5c- Main Characters final	8
Figure 6a- Spotlight Technique in Z-brush	10
Figure 6b- Sample from the spotlight for the skin, hair and mustache	10
Figure 7a- Mixamo Auto Rig tool	12
Figure 7b- Adding the Joints of the body	12
Figure 7c- Testing and finalizing the process	12
Figure 8a- Wrong placed UVs	13
Figure 8b- Intersected dress with the body	13

Figure 9a- Mixamo's motions page	14
Figure 9b- Mixamo's sequence editor	14
Figure 10a- Before the nCloth	15
Figure 10b- nCloth properties	15
Figure 10c- After the nCloth	15
Figure 11a- Mental ray	17
Figure 11b- Image-based lighting	17
Figure 12a- Mapping the image to the dome	18
Figure 12b- Final Gathering sittings	18
Figure 13a- Coffee Traditions in the middle east project	20
Figure 13b- Layers in 3D space	20
Figure 13c- One of the layers	20
Figure 14a- After Effects layout	21
Figure 14b- Effect Controls	21
Figure 14c- Before and after the Cartoon effect	21
Figure 14d- Before and after the Glow effect	22

All images are the property of the author.

Introduction

In computer animation, photorealism is not always a desirable feature. Too much reality-mimicking could, in some cases, work against the crafting of story-telling and essence of the story's message and meanings could easily get lost. In this thesis, I advocate the hand drawing cartoonish style to present an animated short film based on a true story.

During the last three years, the Middle East region was at the centre of everyday world news, Arab Spring spreaded like a fire to several Arab countries and almost everyone was talking about the unpredicted events and what the future going to be. I started my Storyboard since the spring of 2013 and it took almost a year to arrive to its current state, trying to develop the end of the storyboard that I changed several times depending on many factors happened after the Arab Spring.

My original intent was to produce a short animation movie as a 3D short film, but I've decide to explore how the two dimensional hand drawing environment would work with three dimensional animated characters. The goal was to achieve a unique graphic quality combination of a 2D cartoonish hand drawing style while introducing simple lighting, camera movement and visual effects for enhancing visual story-telling. However, my work evolved and focused on the techniques that I have used to achieve the finals especially in merging the 2D hand drawings environment with the 3D animated characters.

Storyboard and Characters

I was born and raised in two different countries in two different continents in the Middle East, then I moved to the United States almost a decade ago. I was mesmerized by the Arab Spring events and how people finally provoked the corruptions and oppressions of their rulers and brought down regimes in some Arab countries. Each country entered a protracted period of political transition that changed and sadly split the people afterward. After following these events for two years I created my storyboard and changed the end several times trying to understand what is the best for the people of the Arab Spring now from my point of view.

My education background is in Architecture and that helped me in creating the environments of my scenes easily with focusing on the details of the street spirits. The characters designs took a quite bit of time to understand the characters personality to maintain the hand drawing of each design.



Characters Design

After selecting the topic of my storyboard and determining the location of my scenes, I focused on understanding and developing a number of factors. The main questions were for example; who are the characters, what are their role in the story, what would be their motivation, what capture their personality and how to make them unique. As a result, I have decided to focus on the following:

1- **The Concept:** I was inspired by the Arab Spring and the unpredicted political events during the last three years, which took place in Egypt. The main character, a young girl represents Egypt, the man in black suit with his briefcase represents corruption, the black cat represents the superstitious idea of bad luck, and the silhouette people in black represents evil.

2- **Simplicity and Personality:** I focused on two important issues in the characters: The expressions on their faces and the style of their clothing. My objectives were to reflect the characters' personalities by simplicity. This was captured as follows:

- The man in black expressing a corrupted political and economical power dressed in a black suit and a black tie and wearing his expensive wristwatch. He, throughout the movie holds his briefcase and smokes a cigar.



Figure 1- Hand drawing the man in black design

- The main character in the movie is a Middle Eastern poor but educated girl in her teens. She is indeed suffering from the consequences of corruption, poverty and social injustice. I intended to express feelings of sadness and hopelessness on her face by focusing on the details of her eyes and eyebrows.

3- **Colors:** I did use a maximum of three colors to keep the design simple and clear. I used somewhat Mediterranean skin color, hazel black eyes and light brown-hatches for the girl's hair and the man's suit.

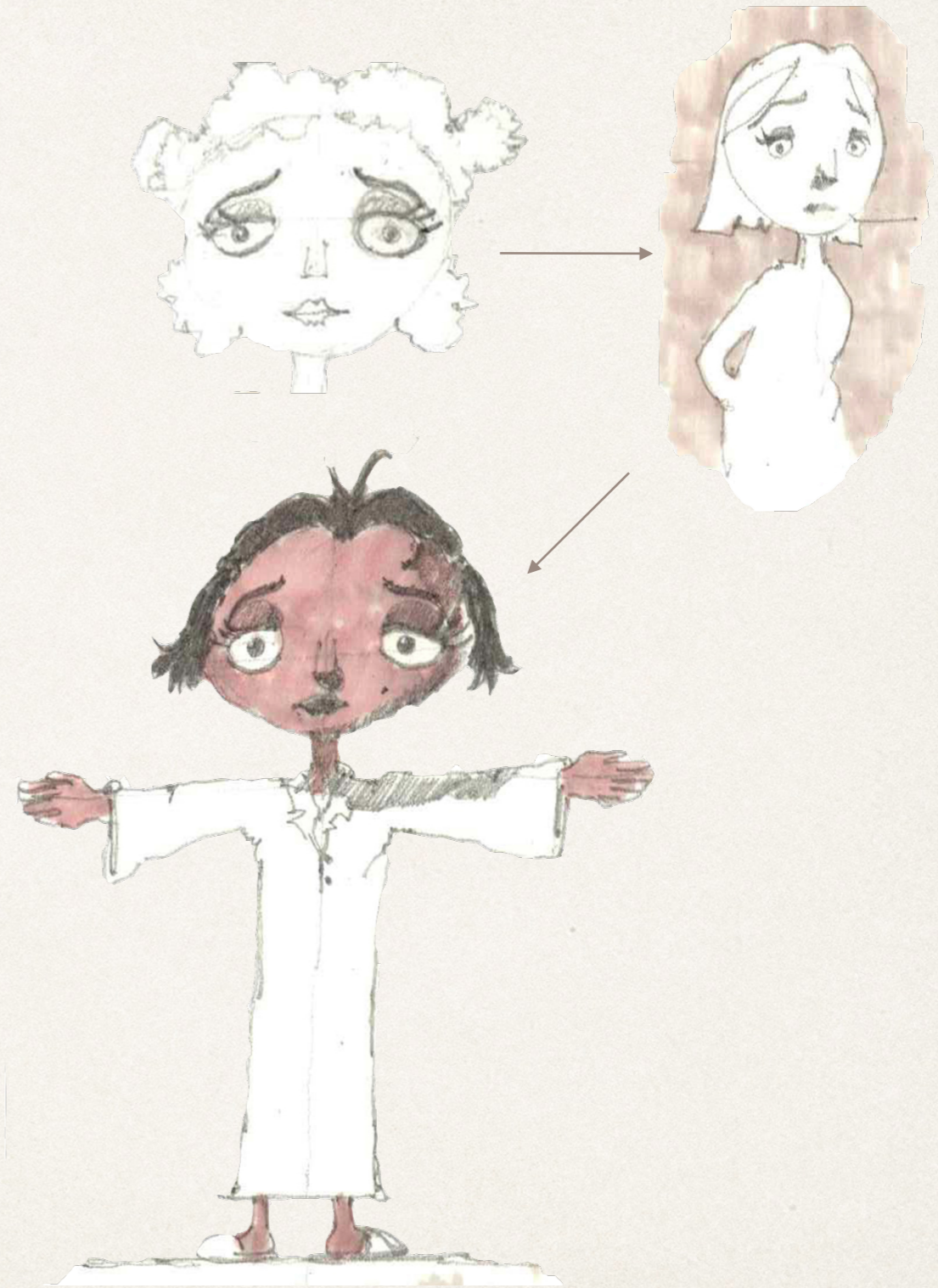


Figure 2- Hand drawing the main character design

Storyboard Development



Figure 3a- Scene 4 before and after adding the details

Being originally from Egypt and speaking Arabic, I was able to informally survey two groups of people, Egyptians living in Egypt and Egyptians living abroad. I have tried to understand their political and social opinions, their views towards the future of Egypt and their hope and fear before and after the January 25th revolution. This had greatly influenced my research and in turn the development of my storyboard.



Figure 3b- Scene 1 before and after adding layers of light in photoshop

My objective was to engage my audience in the atmospheres of the streets of Egypt where I grew up. I addressed that by focusing on the details of the two-dimensional drawings such as street light fixtures, strings of laundry stretched between buildings, and street vendors and sellers. Furthermore, I focused on enhancing my drawing and scenes by adding layers of light using Adobe Photoshop.

Modeling and Sculpting

Modeling is the creative process of making or sculpting three dimensional realistic or unrealistic models using 3D softwares.

With determination and practice I became comfortable with the techniques of modeling characters. I found in modeling my characters that there is no single workflow for every character, every model was done in a slightly different way. The goal was to develop a workflow the allowed me to create the designs in effective and efficient manner.



Modeling the Characters

Along with keeping my characters simple, they had to be unique and stand out. That was addressed through applying varying expressions on their faces including their eyebrows, eye size, nose form and size, cheekbones placement, lip and mouth shapes, overall placement of features, hairlines, and finally their forehead sizes.

I've started by drawing the concept sketches, the front and side orthographic views of the characters that I planned to model. The concept sketches acted as visual references during the process of model construction. I used the orthographic views in Maya 3D to start building my models.

My modeling process started with the creation of the 2D object mesh in 3D. I began with the head and face features modeling, completing the rest of the body, and finally arms and fingers by extruding my four-points quad polygons.

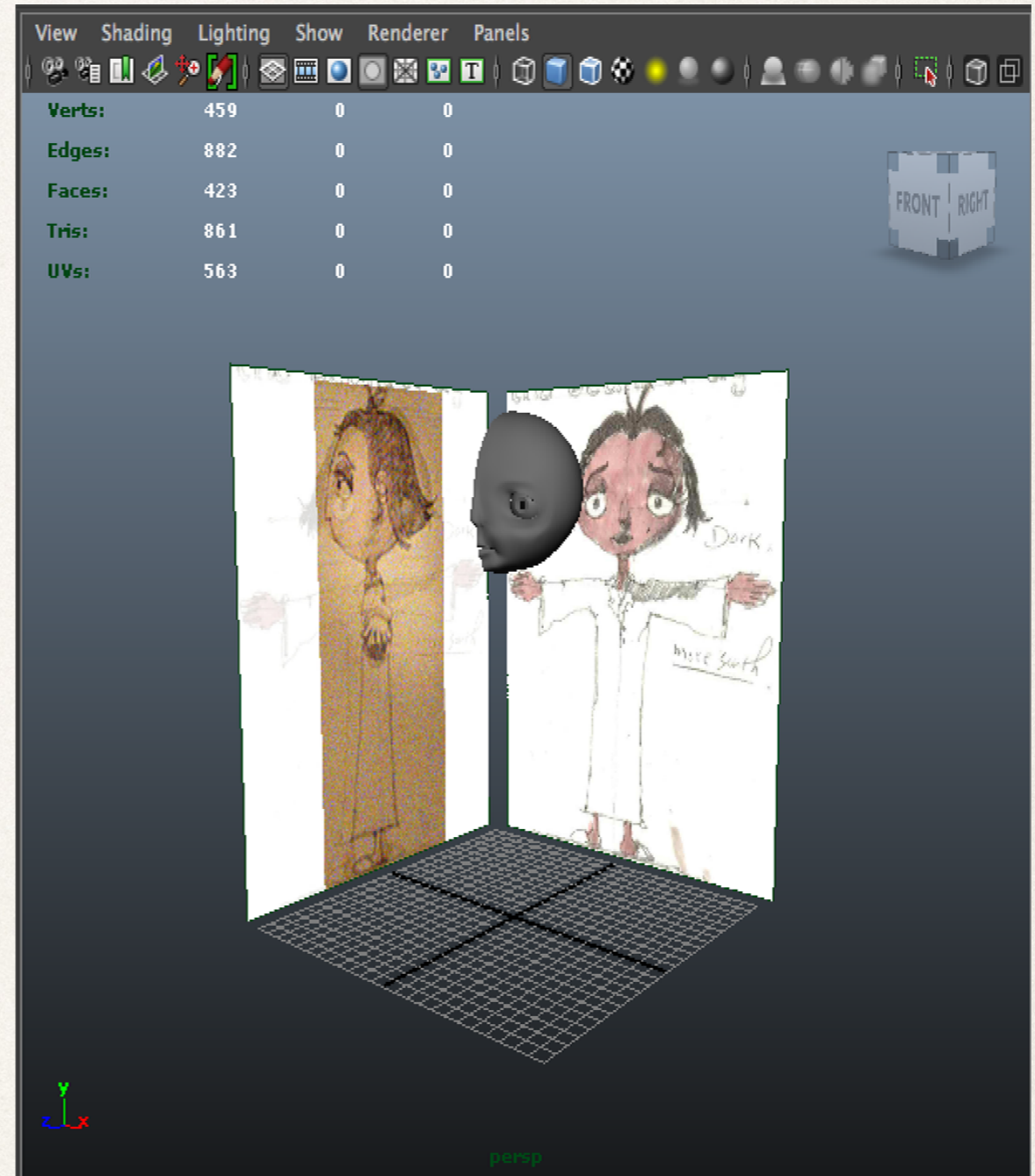


Figure 4- Orthographic Views during model construction

Hair modeling and the eyebrows were quite tricky for me. After I modeled the main character in the story which is the girl using Maya Software, I tried to model her hair using a real hair plugins. After I got the result that I didn't like, I modeled the hair in Maya to maintain the hand drawing style.

Characters clothing has been modeled as well for the characters as follows:

- The girl's outfit: My main character's outfit is a traditional white dress called in Arabic "Abaya" with a collar. She wears a very simple flip-flop.
- The man's suit: Since I didn't model the body of the man in black, therefore the suit, shirt, tie, cigar, sunglasses and shoes were conceived as his body parts beside his head and his hands.

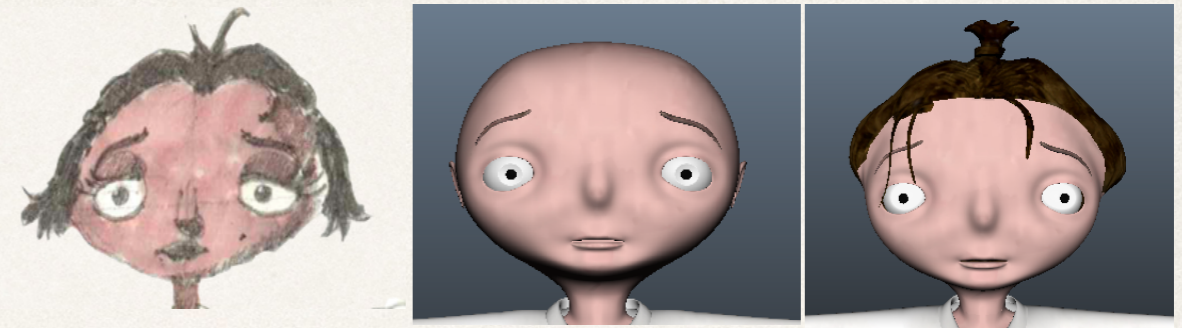


Figure 5a-Main Character

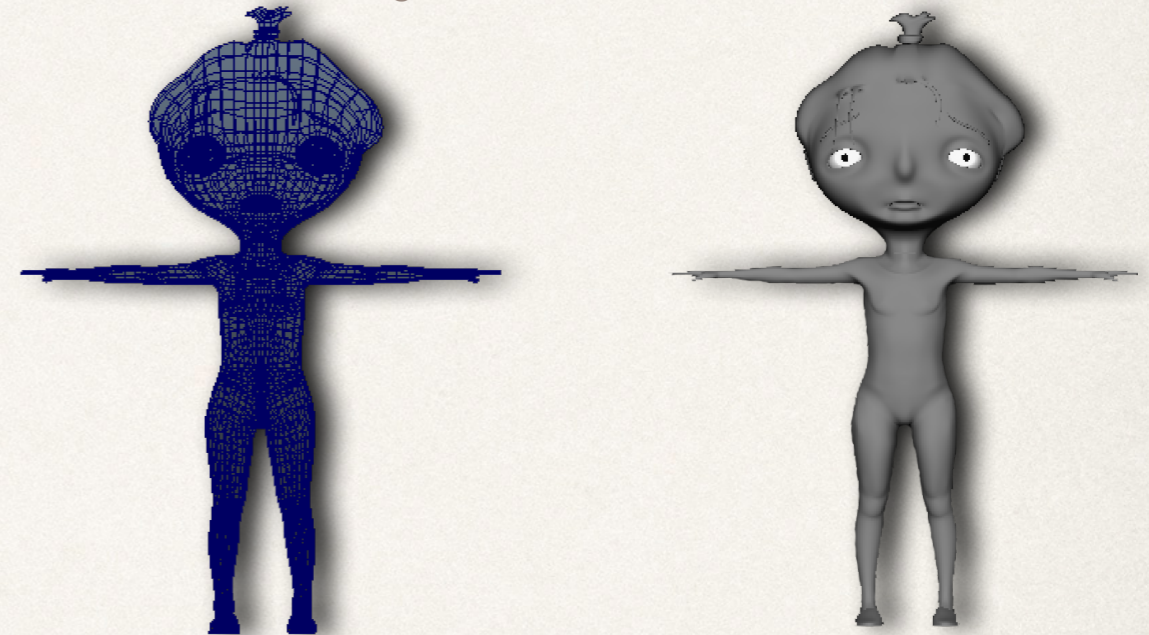


Figure 5b- Wireframe and Shaded Display



Figure 5c- Main Characters final

Texturing

Texturing or Texture-mapping is the process of adding details or colors to the characters. Detailing included clothing, hair and skin color.

For me, as an animator, I usually prefer to use Z-brush software which offers a high degree of details. Without good texturing the best models or environment would seem lifeless.



Applying textures using Z-brush

In order to achieve a unique integration between the two dimensional hand drawings and the three-dimensional character modeling, I had to create an overall cartoonish artistic style. This technique allowed a harmony between the effects of hand drawings and the 3D characters. I started by merging hand-drawn textures to my 3D characters and to their clothing by using spotLight technique in Z-brush.

SpotLight is a projection texturing technique that allowed me to prepare my hand drawing texture directly in Z-brush, and then paint my models with it in 3D. I needed a minimum of two views, the front and the side views to paint my models.

SpotLight technique included many features that I used to add hand drawing texture correctly. Some of the features that I used were: scaling, rotating, opacity and nudge tool to stretch, move and distort portions of the images.

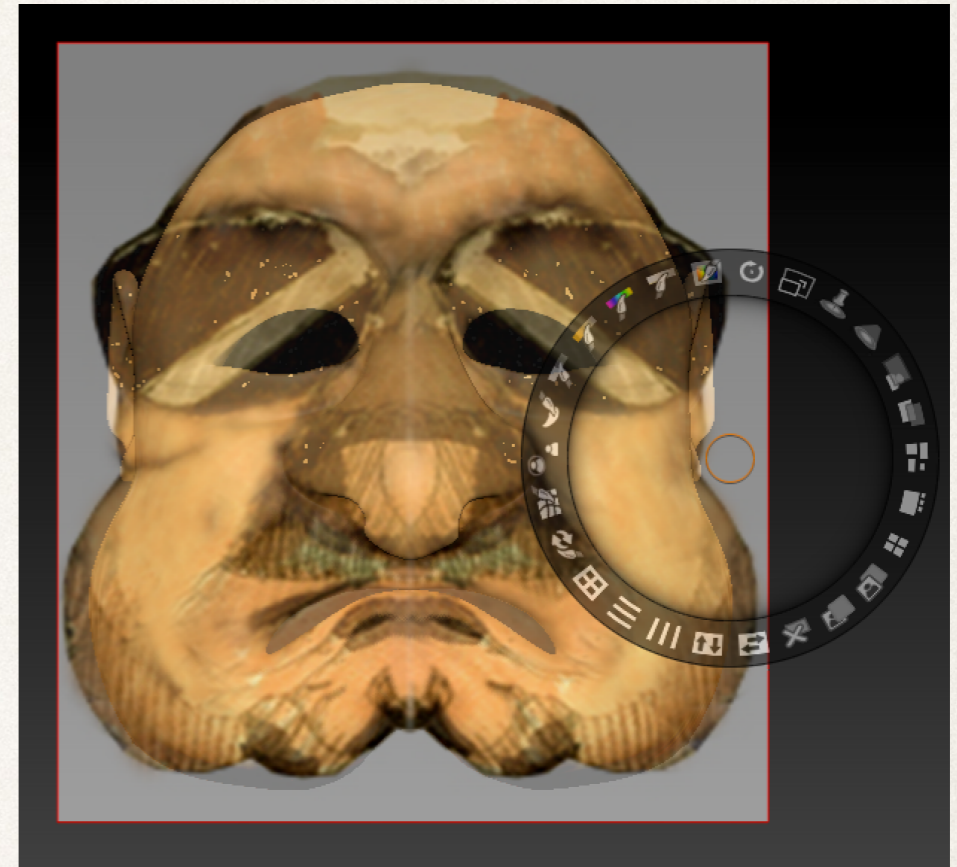


Figure 6a- Spotlight Technique in Z-brush



Figure 6b- Sample from the spotlight for the skin, hair and mustache

Rigging and Animation

A character rig is a digital skeleton applied to the 3D characters and make it looks like the real skeleton. Rigging is a system of joints, bones and control handles that give the animators the ability to animate the characters.

3D Animation is the process of creating motions by key framing method somewhat similar to those that have been used in traditional two-dimensional (2D) animation. However, I've applied the motions to my characters and some scenes I animate the characters manual.



Rigging

I have used the Mixamo Auto Rig tool , which was offered, by our school of visual arts for students. Mixamo Auto Rig tool, known for its quick results, has helped me to accomplish the rigging part in significant less time than normal.

The rigging process was as follows: I uploaded my mesh models as (.fbx) format with its textures as an embeded media under (fbx) options in Maya. The file size shouldn't exceed 30 MB. Then, I dragged and dropped the marker symbols to the corresponding parts of the character. This helped the auto-rigger fit to my custom body. I had the opportunity to choose the skeleton level of details to change the number of fingers to use, but I preferred the standard Skeleton.

The preview animations and the quick feedback from the tool allowed me to make informed design decisions and to test the rig and finalize the process.

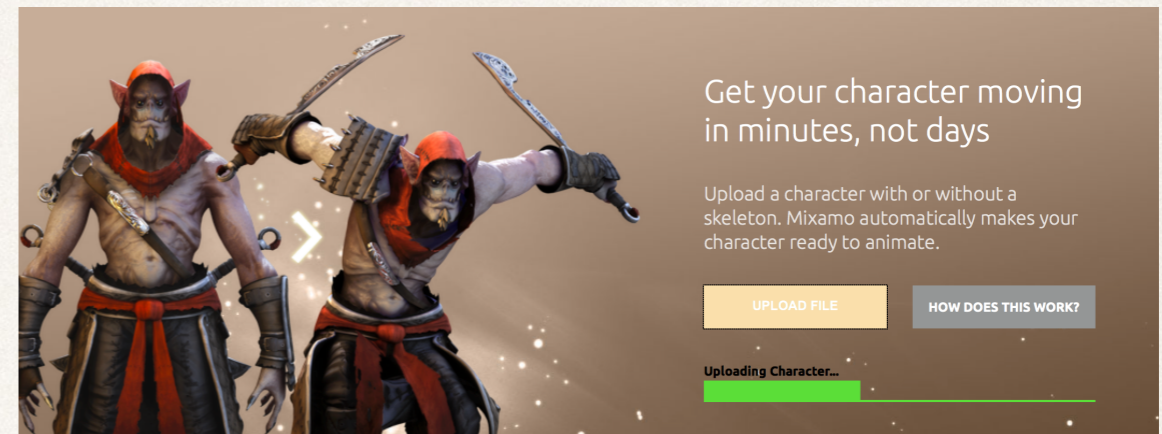


Figure 7a- Mixamo Auto Rig tool

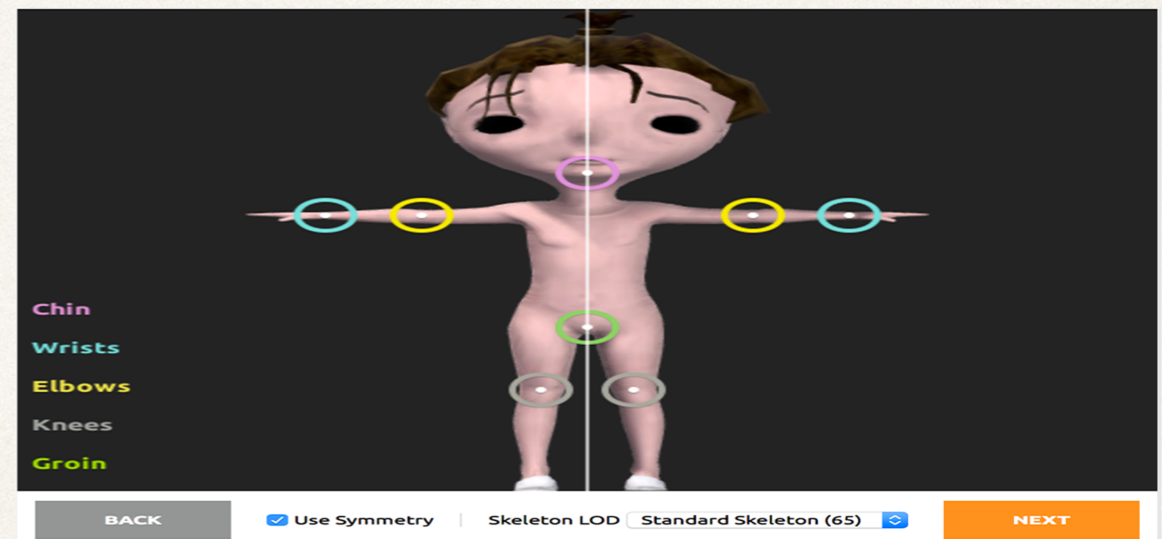


Figure 7b- Adding the Joints of the body

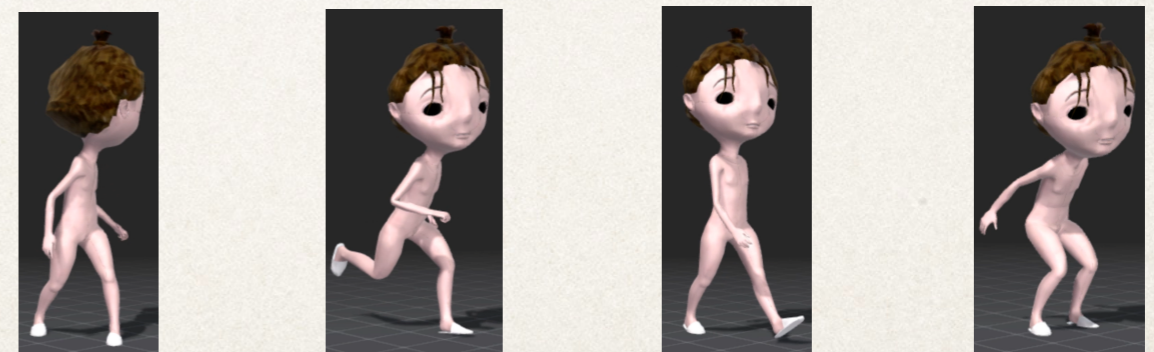


Figure 7c- Testing and finalizing the process

Difficulties and Challenges

I faced a number of difficulties during the rigging process as follows:

1- I uploaded my mesh model as (.fbx) format but was not successful before the rigging. Therefore I checked the low polygon model in Maya, corrected some of the vertices that intersected with others. The UVs placed right as well and the model was ready.

2- I tried to rig the girl with her dress, but as shown in the figure the body looked not right and the body looked smashed. This was beside when I applied motions to the model, the dress intersected with the body. To solve this problem I rigged only the body and added the dress after the rigging and the animation.



Figure 8a- Wrong placed UVs

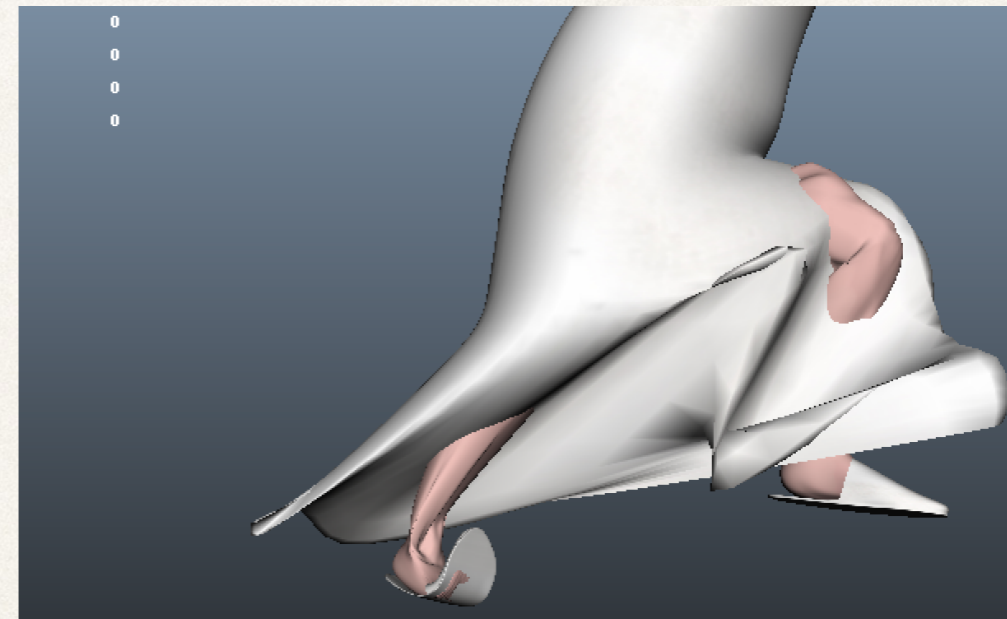


Figure 8b- Intersected dress with the body

Animations

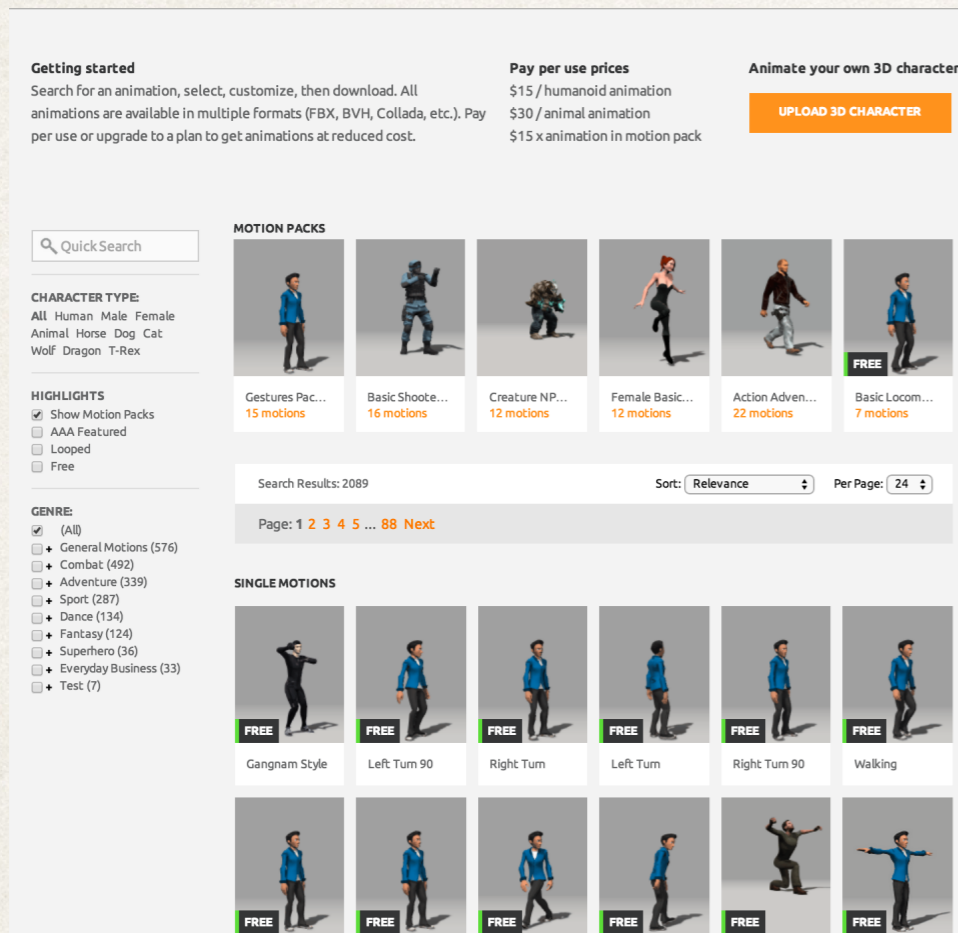


Figure 9a- Mixamo's motions page

After auto rigging my characters, choosing motions that are needed for the scenes from a big collection in Mixamo's library. It has the search bar and categories to find the motions that is perfect. Each motion has sliders including the speed of the motion, Distance between the arms and the body, which used in

all motions to keep the dress's sleeves away from the body and Trim slider where I could control the motion's length. Adding more motions was possible to the sequence in Mixamo, but sometimes the blends in between were not correct especially if there was any trim in one of the motions. I had to add a separate sequence with additional animations either by creating keyframes or using motion capture.

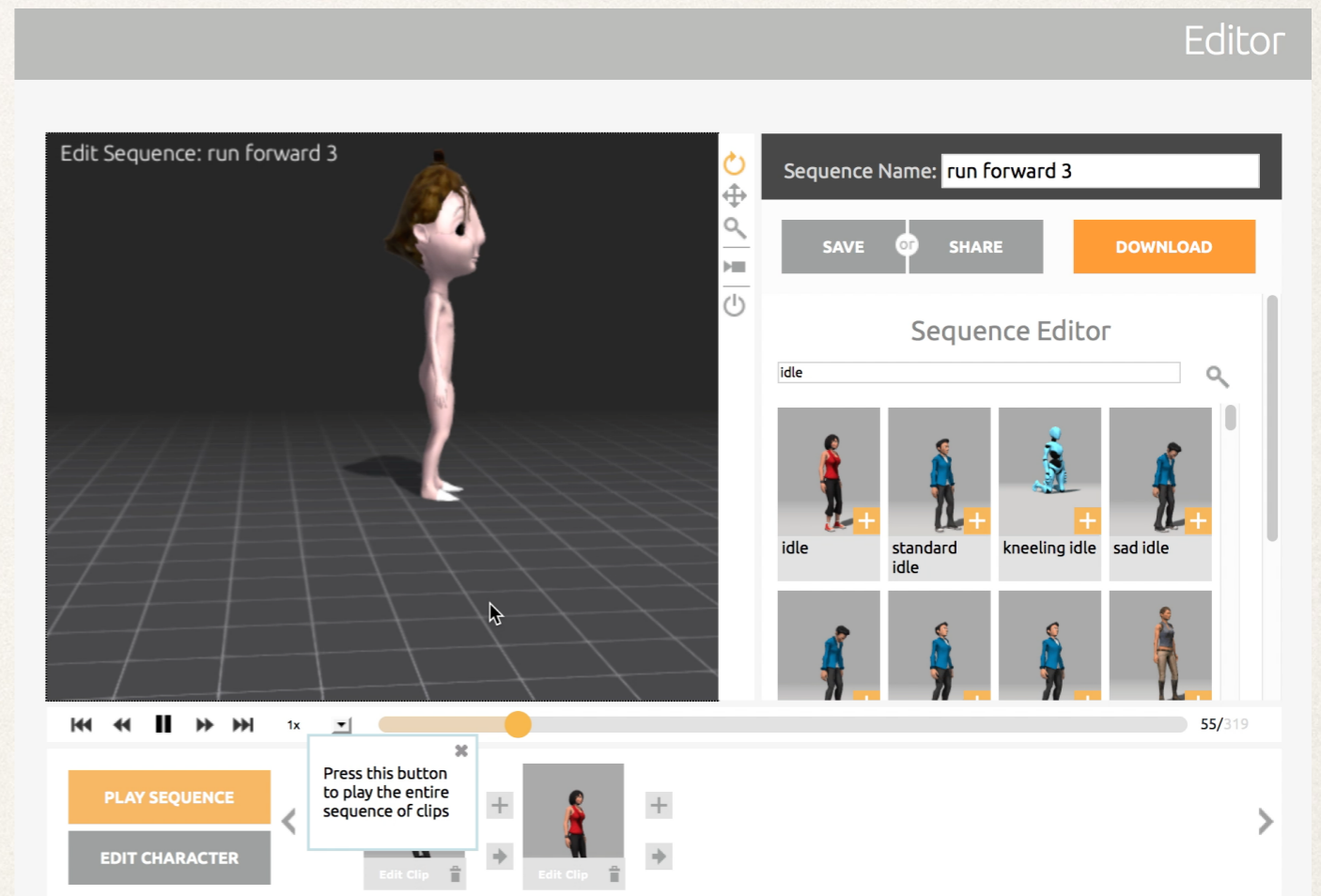


Figure 9b- Mixamo's sequence editor

nCloth Simulation

When I applied motions to the main character's model, the dress intersected with the body. To solve this problem and after I animated the body, I used nCloth for the dress. nCloth is a dynamic cloth simulation that uses a proprietary simulation engine called Nucleus to simulate a wide range of polygon surfaces. I modeled the main character dress and made it an nCloth object. Despite its name, nCloth isn't only for simulating clothing.

The nCloth object properties determine the physical characteristics of the cloth. These properties affect how the cloth interacts with the body and how it behaves. The nCloth properties are found in the Attribute Editor of the nCloth shape node. While there are many different settings within each property, as long as I know the affects they have on the nCloth I could experiment with these settings to get the desired result.

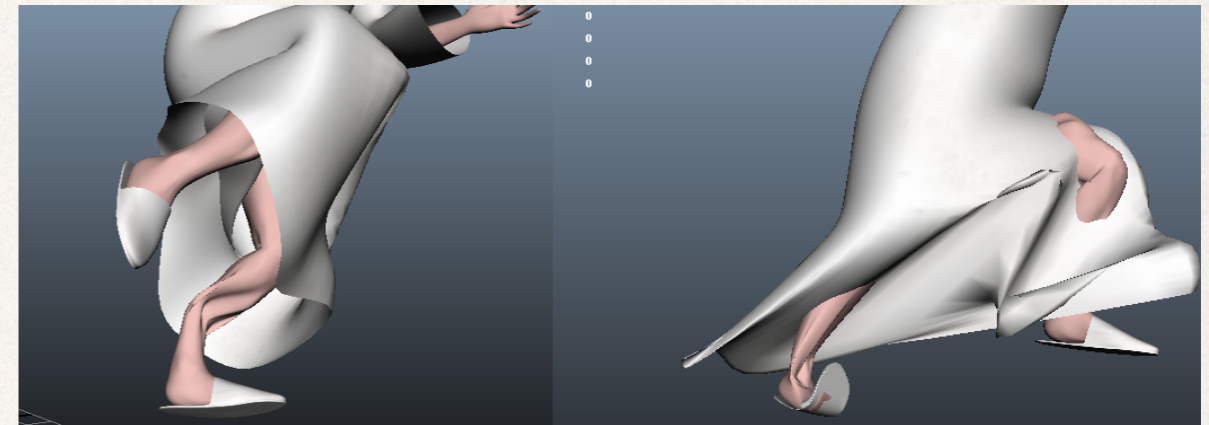


Figure 10a- Before the nCloth

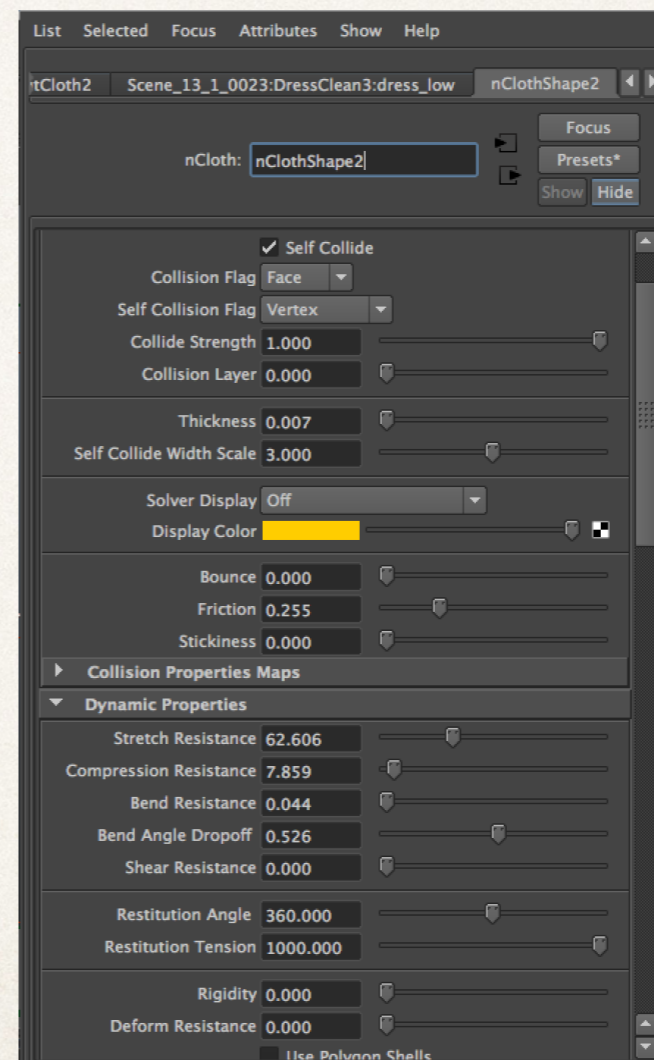


Figure 10b- nCloth properties

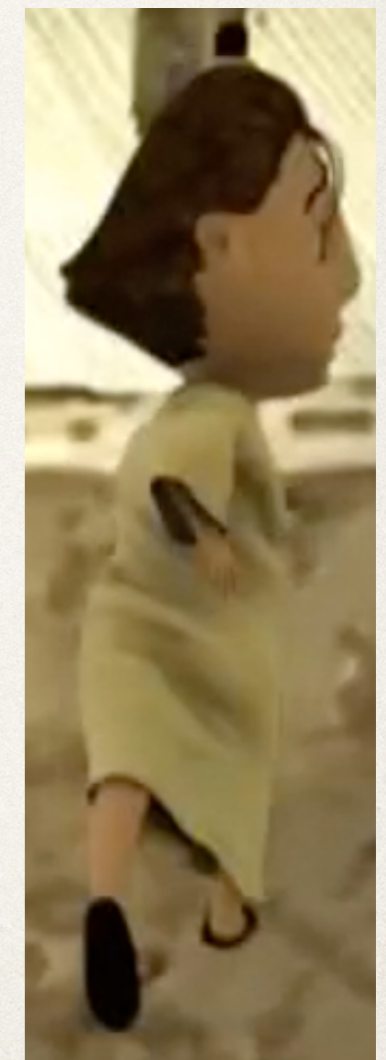


Figure 10c- After the nCloth

Lighting and Rendering

In my work, I intended to combine hand drawing scenes with cinematic lighting aesthetic in 3D computer graphics. A workflow of image based Non-Photorealistic lighting method combined with using the right sittings for the rendering developed to achieve the final look.

Lighting and Rendering Settings

At this stage of my work, I used Mental ray. Mental ray was used to achieve high quality effects that typically cannot be found in some of the default render engines in programs like Maya and it is an extremely powerful render engine that has the capabilities of producing high quality renders.

I used image-based lighting for the scenes, which can accomplish 80% of the required tasks instead of creating all the lighting from scratch, and to ensure the work matches the hand drawing imagery.

Image-based lighting uses an image to create lighting in a scene. Essentially, Maya looks at the color of each pixel of the image, and creates a light based on that color. The result was lighting in the scenes that matches the lighting in the photographs.

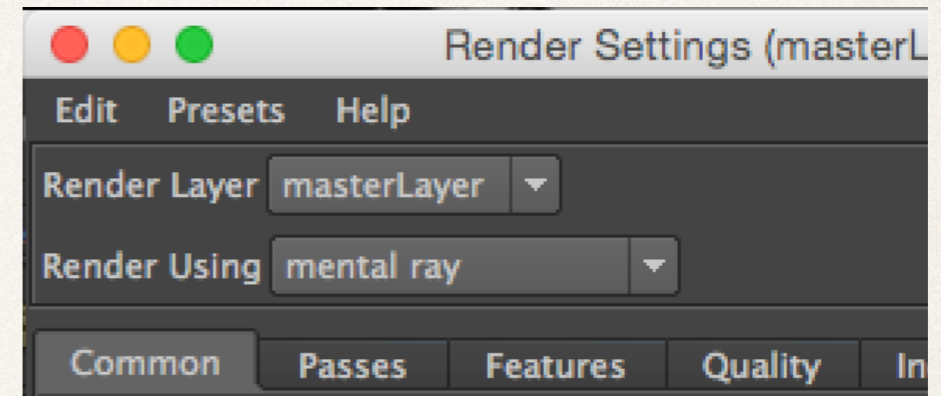


Figure 11a- Mental ray

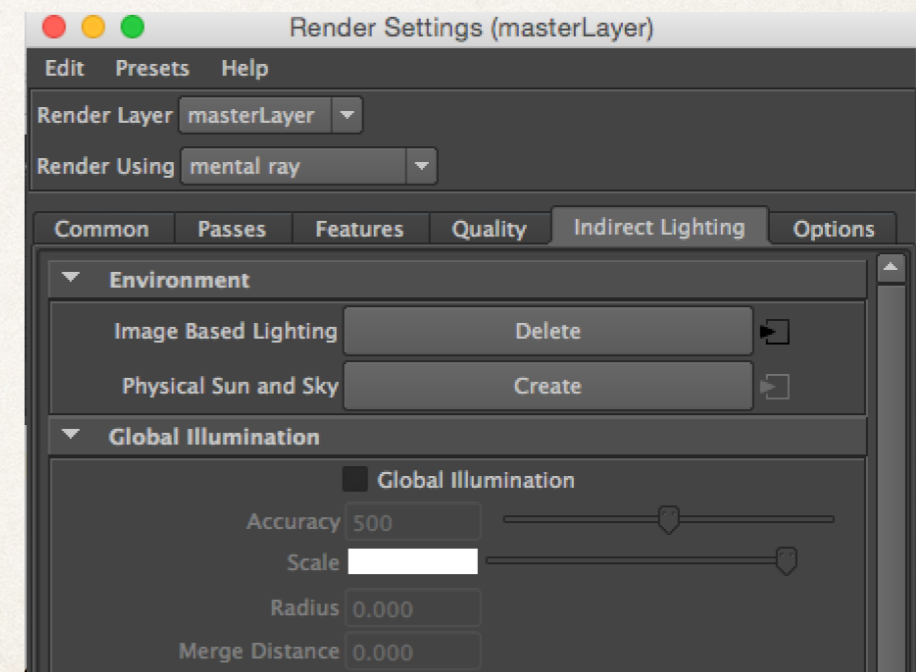


Figure 11b- Image-based lighting

In the attribute editor of the image-based lighting I had the option to map an image to the dome.

One important aspect when using image based lighting is that I needed to enable final gather in order to calculate the image's lighting into scene.

Using an image-based light setup for the scene suggested that Final Gather is a must because without Final Gather the image-based light won't be calculated in the scene.

In the real world a lot of the light that humans see is the direct result of indirect illumination (e.g., light that isn't coming directly from a source like a light bulb). Another benefit to using FG is that I actually didn't need a light source in the scenes. Final Gather simulated indirect illumination based on the colors and materials in the scene, which is also why I needed Final Gather in order for image based lighting to work. Increasing the accuracy of final gather which basically increases the quality. Of course, this increased the render time to the maximum this value is. I also increased the Point Density and Point Interpolation to smoothen out the final render.

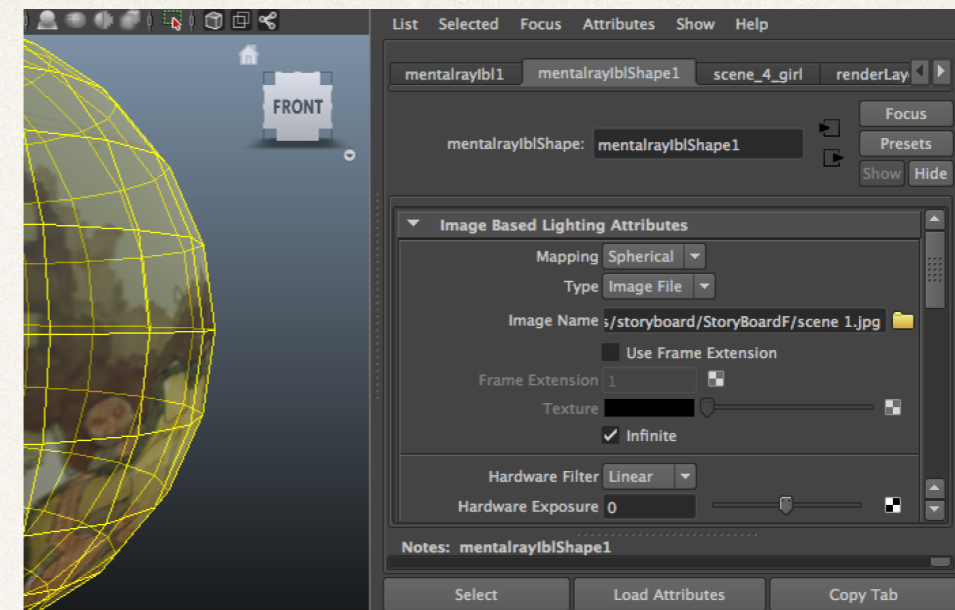


Figure 12a- Mapping the image to the dome

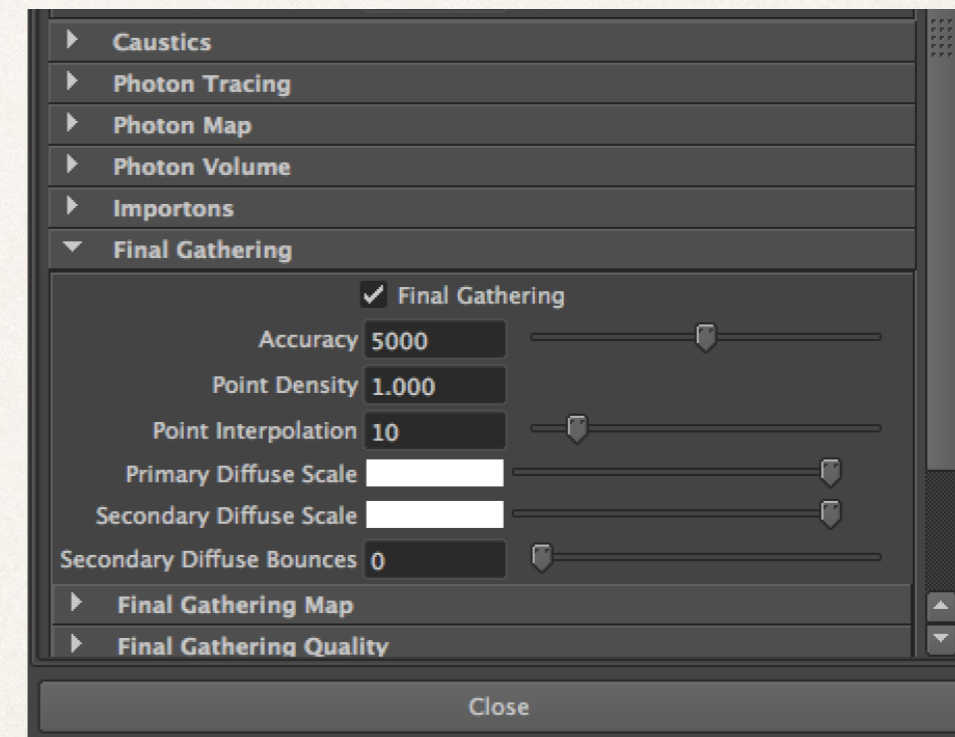


Figure 12b- Final Gathering settings

2.5D Effect

I have always wondered about and wanted to explore how 2D environments and 3D animated characters would appear in digital media forms and displays with the 2.5D effect?

After Effects is a program developed by Adobe Systems which allowed me to apply visual effects to my scenes.



Parallax Effect

One of the projects that I have developed before my thesis project named “*Coffee Traditions in The Middle East*”. The technique that I used in this project was the *parallax effect* or the 2.5D effect. The Parallax effect is what happened when creating the illusion of depth with completely flat, two-dimensional objects by moving different background and foreground elements at varying speeds. Parallax is described as: “*an apparent displacement or difference of orientation of an object viewed along two different lines of sight, and is measured by the angle or semi-angle of inclination between those two lines.*” What this means to After Effects users is that real camera moves have parallax.

1-The first step in creating the implied depth lies in separating the subject of the hand drawing image from the background and other elements.

2- Adding depth: Arranging layers in 3D space. Once I finished slicing up the image in Photoshop, it’s time to import it into After Effects to add that much-needed depth. After all the layers are converted to 3D space, I pulled them out to different points on the Z axis and added a 3D camera, which would be the only object that changes position on the timeline as shown in figure 13b.

3- Adding Life: Animating the Scene. Once everything has been arranged in 3D space, I animated the camera along a motion path to create the parallax shift and complete the effect.



Figure 13a- Coffee Traditions in the middle east

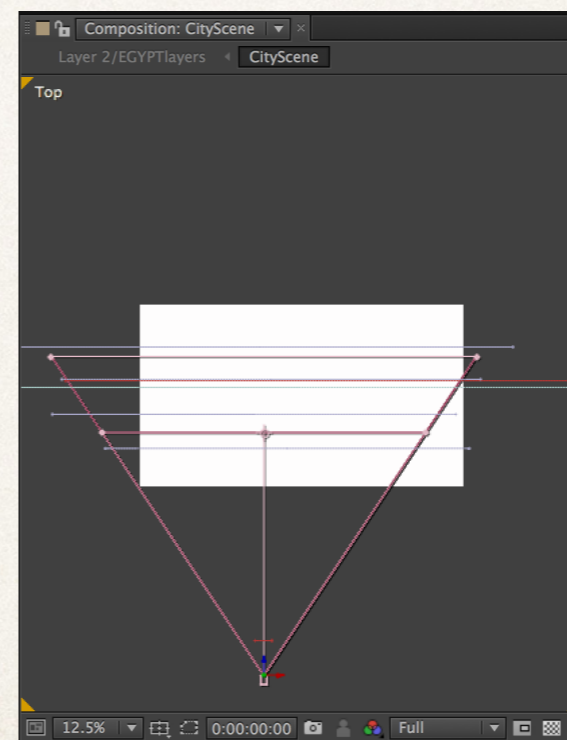


Figure 13b- Layers in 3D space

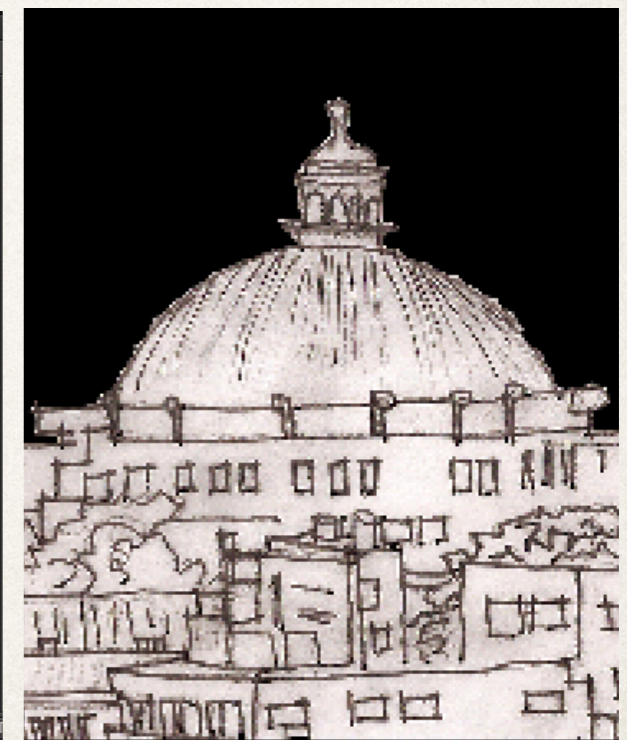


Figure 13c- One of the layers

Integrating 3D characters to 2D environments.

I rendered the animated characters for each scene separately in Maya as (.tiff) sequence and the Alpha channel box checked on to flatten the animated character layer, then imported the sequence in AE. I've used the same technique of the 2.5D effect in my thesis project that created in After Effects. The basic idea behind a parallax was that 3 dimensional elements appear to move differently depending on their position relative to the observer.

Applying Visual Effects to layers: To have the 3D animated characters look right with the 2D environment layers, I applied effects to my 3D characters to maintain the hand drawing cartoonish style and to give the 2D effect to characters.

The Cartoon Effect

The cartoon effect simplifies and smooths the shading and colors in a layer and adds strokes to the edges between features. The overall result was to decrease contrast in areas with low contrast and increase contrast in areas with high contrast. With adjusting the Edge Width, Strength, Color and it's Paint Frequency, stroke length and seed for each character sequence layer gave me the final look that I was striving for and as shown in figure 14C.

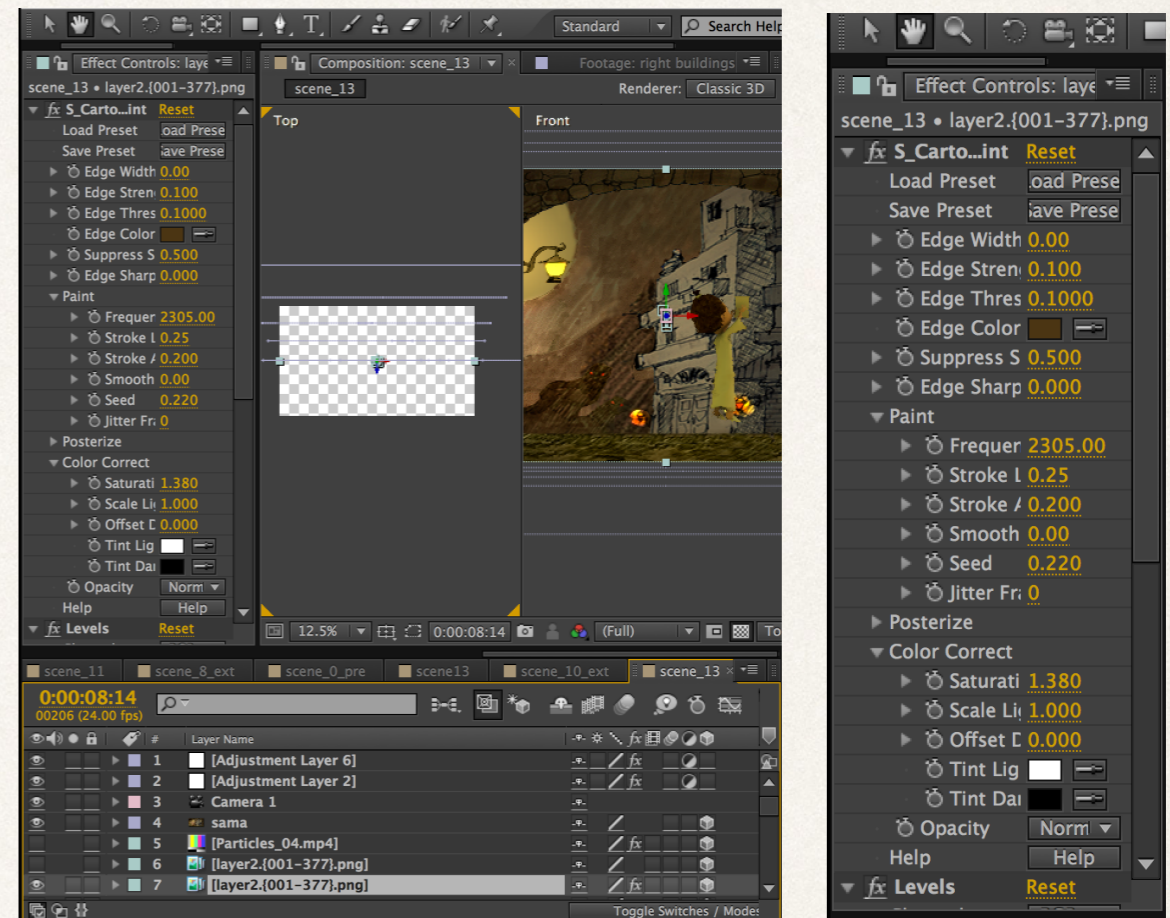


Figure 14a- After Effects layout

Figure 14b- Effect Controls



Figure 14c- Before and after the Cartoon effect

The Glow Effect

The Glow effect finds the brighter parts of an image and then brightens its pixels and the surrounding pixels to create a diffuse, glowing aura. The Glow effect can also simulate overexposure of brightly lit objects. One could base the glow on either the original colors of the image or on its alpha channel. Glows based on alpha channels produce diffuse brightness only at the edges of the image, between the opaque and transparent regions.



Figure 14d- Before and after the Glow effect

Editing and Compositing

Editing and Compositing was the final and the most important stage of my work production. The process was not only responsible for weaving all of the final renders together that make sense to the eyes but also responsible for the sound mixer of the different pieces of music and sound effects together, so it can make sense to the ear as well.

Combining the final scenes and adding transitions in-between which need to train the eyes on focusing on the small details and to know where do I need to add transitions . As well as combining the sound effects, music and narration with the final scenes needs to train the ears on focusing on where should I make the volume of the sound effects louder than the music, or the narration's volume louder than music and the sound effects.



Editing and Compositing

After applying the effects, I've rendered the final scenes using *Adobe After Effects* and choosing the sound effects, I came to the compositing stage using *Final Cut Pro* program.

Compositing is described as *“the combining of visual elements from separate sources into single images, often to create the illusion that all those elements are parts of the same scene.”* To make it more simple Compositing in my work was the process of combining each rendered scene to create a final short film by adding the title of the movie, each scene and transitions, the sound effects and it's transitions and the credits by the end, rendered the final and export the file as a movie. It sounds an easy step but actually it took a very long time and efforts to apply the right sound effects with the animated effects and the narration of each scene.

Final Movie

<https://www.dropbox.com/lightbox/home/Thesis%20finals>

Conclusion

The making of January 25, story of a girl were indeed both interesting and challenging endeavor. The development of the story and the process of making it was over shadowed and in some case paralleled by my own personal story. The journey went over two and a half years and were full of obstacles and challenges. I have discovered that 3D computer animation has many different stages in the process of developing my work, the most important part was the storyboard stage where decisions on integrating 2D and 3D animation were critical to the realization of my work.

Integrating 3D animated characters with 2D hand drawings environment techniques were essential because it overcomes certain challenges such as preserving the effect of the cartoonish artistic style in the short film, using the render settings in Maya to flatten the 3D animated characters and using the 2.5D effect (Parallax).

At the end and during my work I had challenged myself before challenging any difficulties. I had learned how to develop short animation and how to solve the problems by researching and experimenting with many techniques to reach the best results in each stage of the animation.

In my opinion, the integration of the two dimensional and the three dimensional animation was complementary and I would like in the future to develop and produce more animations using this integration. My future work will bring more of my background in Architecture into the making of 3D animation short films. This area of focus although have been explored before in cinema and scholars such as Juhani Pallasmaa wrote about, it poses an interesting area of future research and development in 3D short animation films. What is the role of architecture in 3D short animation is a future inquiry that I have started working on.

References

Autodesk Maya:

[1] Palamar, Todd, and Eric Keller. Mastering Autodesk Maya 2012. John Wiley & Sons, 2011.

Adobe After Effects:

[2] Christiansen, Mark. Adobe After Effects CC Visual Effects and Compositing Studio Techniques. Adobe Press, 2013.

Adobe Photoshop:

[3] Photoshop, Adobe. "Adobe Photoshop 5.0 Limited Edition, Chapter 4: Making Color and Tonal Adjustments." Jan 1 (1998): 67-89.

Final Cut Pro:

[4] Brenneis, Lisa. Final Cut Pro 3 for Macintosh: Visual QuickPro Guide. Peachpit Press, 2002.

Pixologic ZBrush:

[5] PIXOLOGIC TEAM. "Zbrush 3.5 What's New Documentation." Pixologic, Inc.[online] <http://www.pixologic.com/zbrush/downloadcenter> (2009).