

Final Oral PRESENTATION



BScCM Final Year Project Presentation 2021/22 (Sem.B)-
SM4701/SM4712B

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‘AZALEA’



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Animation

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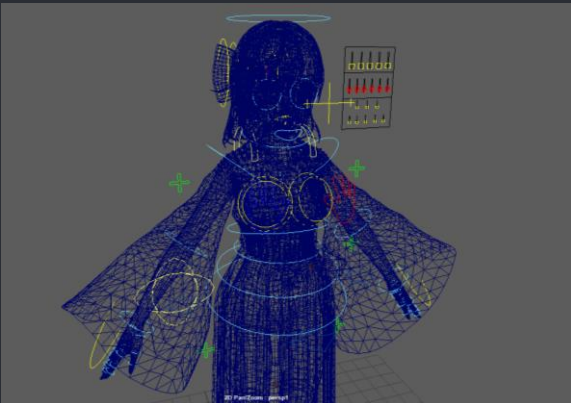
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01 Introduction

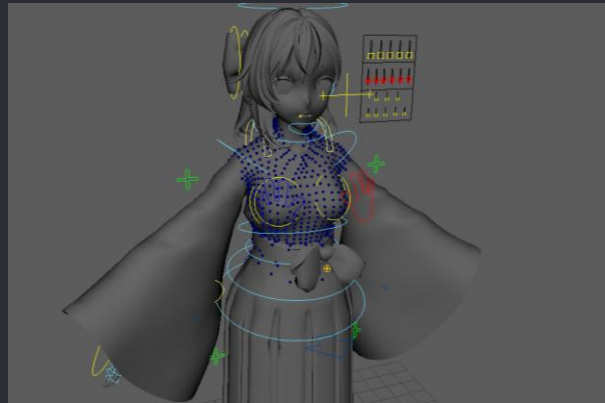
My final project is a short 3D character animation that combines rigging, toon rendering and other techniques.
Mainly using Maya 2020.

Skeleton Binding



Skeletal animation is an animation generated by rigging various parts of the character's body model to the "bones" that are connected to each other, and to make character act by controlling the bones position, rotation direction, and zooming in and out.

Toon Rendering



Toon Rendering is designed to give computer-generated images a hand-drawn-like effect, in order to make the image look like a comic or cartoon. It is a new technology that emerged around the early 2000s as a by-product of computer graphics and is mainly used in video games.

Character Animation



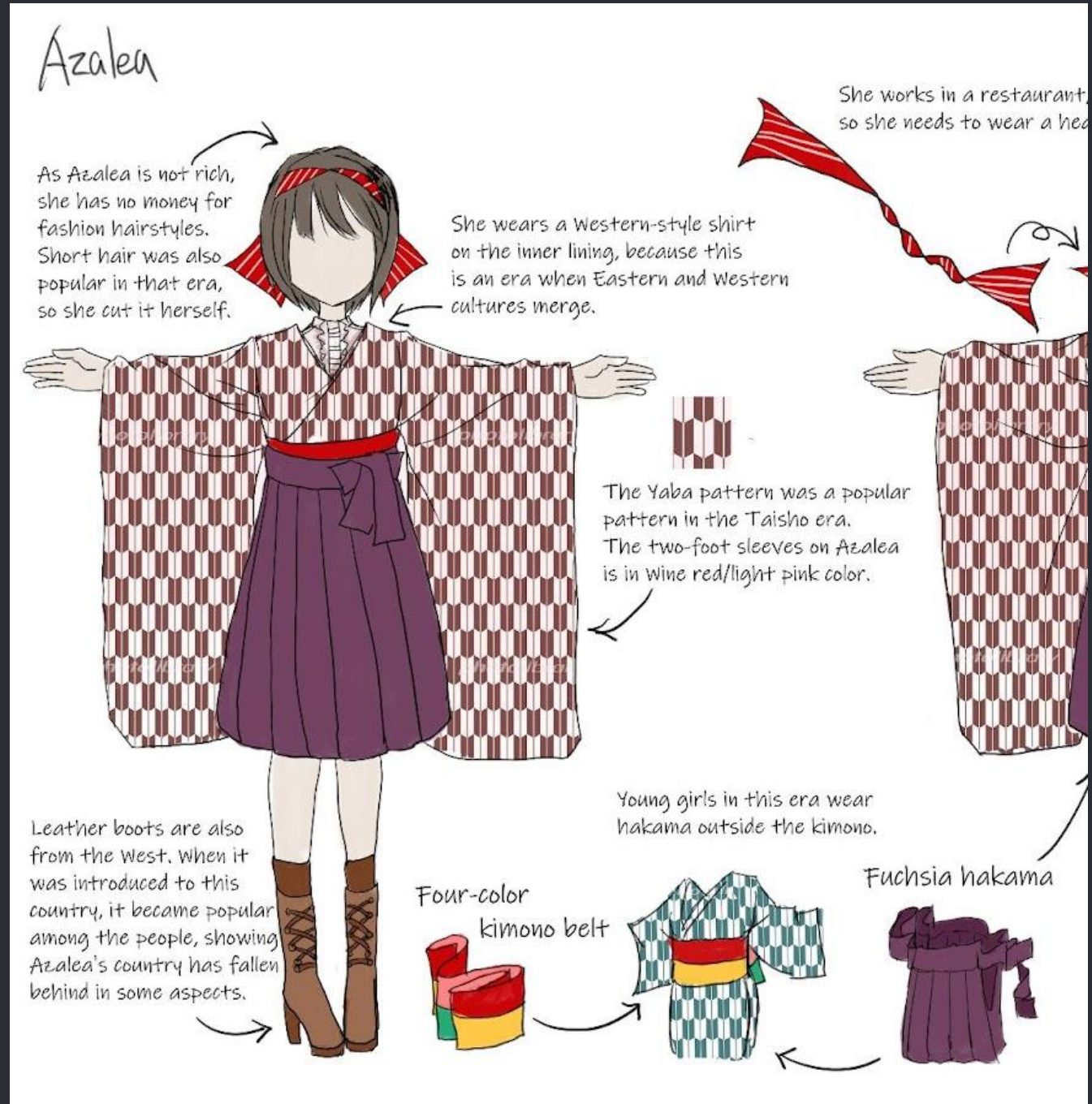
Character animation is generally defined as the art of making a specific character move in a two- or three-dimensional environment. The final outcome of this project is a 6-minute 3D character animation short film.

Story Idea

Azalea is the name of the heroine of the animation, and at the same time, Azalea is also the name of a kind of flower. The azalea flower is the thread of the whole story. In the animation, the heroine chases the azalea flower, leading the audience's eyes from the beginning to the end of the story.

The theme of the story is about war and peace. The story's historical background is set in a fictional country in East Asian in the 1920s. The girl Azalea's father is an army officer, but in order to escape the war, Azalea is still displaced. The animation contains a traditional saying that when an azalea falls, it indicates that a person will die, and all the storylines confirm this telling.

Full Animation(Final version): <https://youtu.be/OsbE7VH0vi8>



Basic Plot

Each scene in the story is equivalent to a paragraph. The scenes are not repeated, so it is linear narrative.



Railway Bridge

Chasing after seeing the **azalea flower**, Azalea coincidentally escaped the bombing of the railway bridge.



Abandoned Shelter

Azalea survives by falling into an abandoned bomb shelter. Here she finds some glowing azalea flowers.



Woods

The azalea flower took Azalea to a wood, where Azalea found her father's grave.

Military Base

Instead of finding her father/**the azalea flower** at the base, Azalea found a note asking her to find "peace".



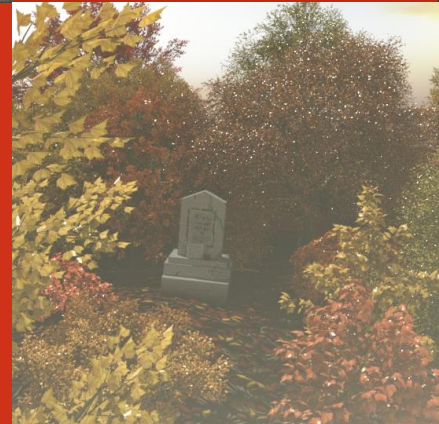
Peace Harbor

Azalea fled to the Peace Harbour, but the city was still attacked by enemies not long after.



Ruined City

When Azalea climbed out again, the entire city was in ruins. She found **the original azalea flower** in the ruins.

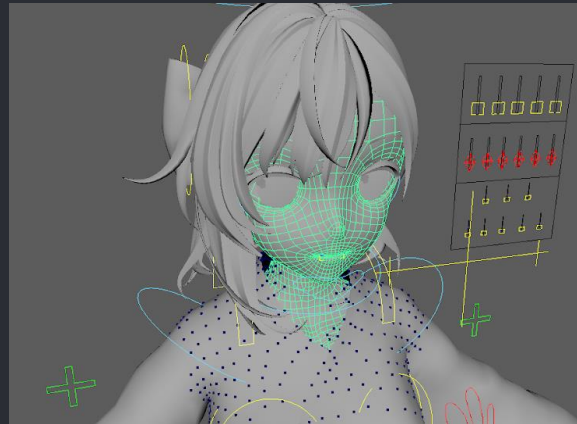


Full Animation(Final version): <https://youtu.be/OsbE7VH0vi8>

02 Tasks & Outcome

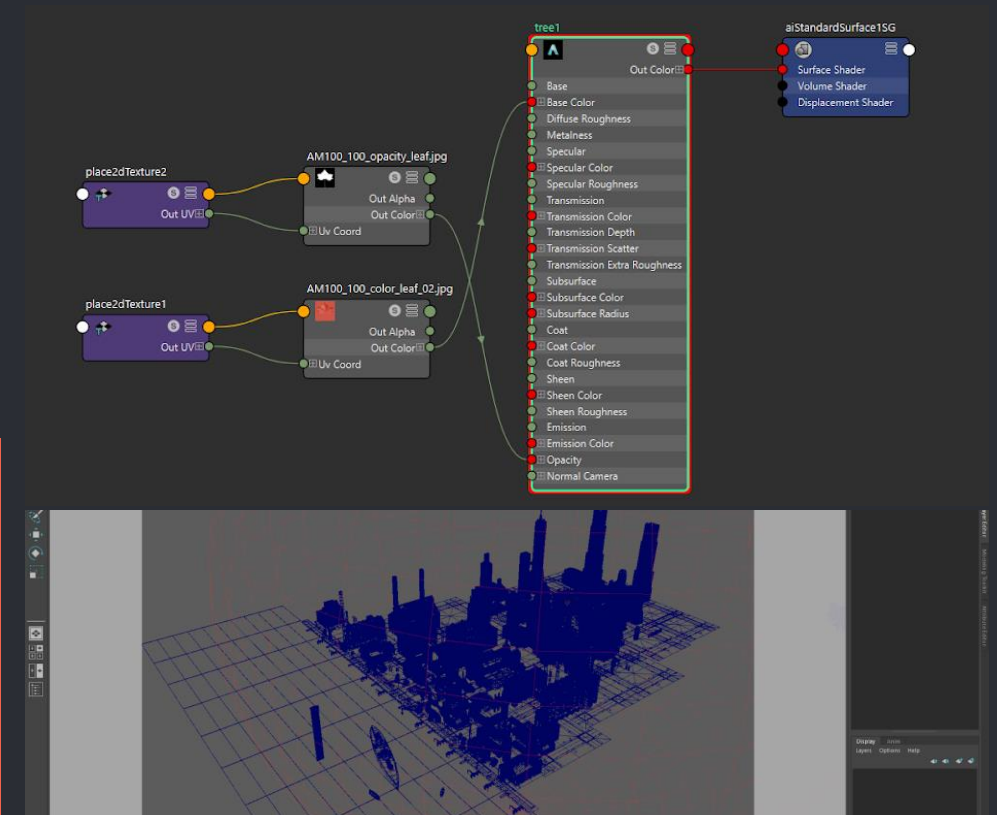
There are two main directions of the tasks, one is the technical requirements, and the other is the effect of art. Technology is a tool to complete the animation, but at the same time to ensure the integrity of the animation's plot. Therefore, when a kind technology cannot be applied, there must be a remedy, otherwise, the animation will lose its artistic meaning.

```
1 //-----  
2 //----- Batch Operation Tool. -----  
3 //----- Optimize the lens file. -----  
4 //----- WeiHero. -----  
5 //----- CutModOptimize. -----  
6 //----- 2018-07-23. -----  
7 //-----  
8 //-----  
9 global proc PointCreation()  
10 {  
11 {  
12 if("window -ex CreationJoint") {deleteUI CreationJoint;}  
13  
14 window -title "PointCreation" -sizeable 1 -tlb 0 Creati  
15 rowColumnLayout -numberOfColumns 1 ;  
16 text -l "";  
17 text -label "====Select the point of the model.===";  
18 text -label "==== UV must not overlap. ===";  
19 text -l "";  
20 button -label "Point creation joint" -bgc 0.5 0.65 0.5 -  
21  
22 separator -h 5 -style "out" "a";  
23  
24 rowColumnLayout -numberOfColumns 1 ;  
25 text -l "";  
26 text -label "====Select the point of the model.===";  
27 text -l "";  
28 button -label "Point creation locator" -bgc 0.5 0.65 0.5  
29  
30 separator -h 5 -style "out" "a";  
31  
32 rowColumnLayout -numberOfColumns 1 ;  
33 text -l "";  
34 text -label "====Select an object.===";  
35 text -l "";  
36 button -label "Centre creation joint" -bgc 0.5 0.65 0.5  
37  
38 separator -h 5 -style "out" "a";  
39  
40 rowColumnLayout -numberOfColumns 1 ;  
41 text -l "";  
42 text -label "====Select an object.===";  
43 text -l "";  
44 button -label "Centre creation locator" -bgc 0.5 0.65 0.  
45 text -label "==== WeiHero ===" -bgc 0.2 0.2 0.2 -en 1;  
46 }
```



Main Tasks

- Bone rigging and skinning
- Cloth simulation
- Shading and rendering



Fast Track Video: <https://youtu.be/lkQl6BDIV2o>

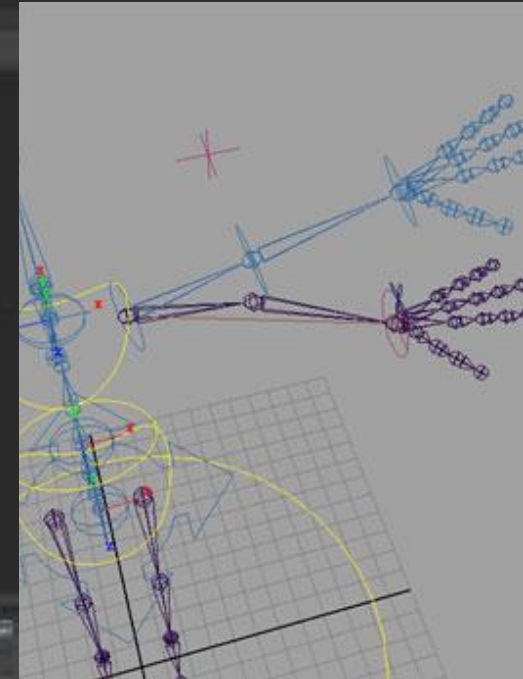
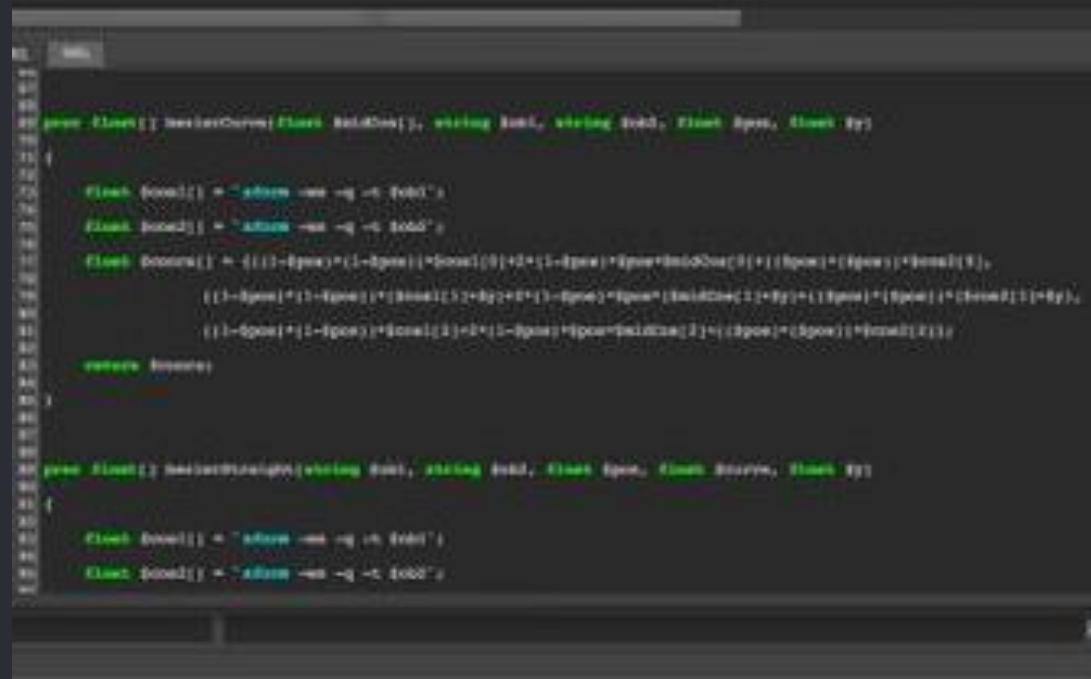
Skeleton Rigging

Major technical issues

Actions of characters in animation/games are essential, and the way to achieve them is applying frame animation or skeletal animation. The difference between frame animation and skeletal animation is that each frame of frame animation is a snapshot of the character's specific pose. The skeletal animation is an animation generated by binding the various parts of the character model to the "bones" that are connected to each other, and by controlling the position, rotation direction, and zooming in and out of the bones to make the character move.

My project uses skeletal rigging method. Features:

- Fewer art skill is required
- Better fluency
- Higher computing requirements
- Uses code to control bone movement
- Motion parameters can be reused



Cloth Simulation



In the physics engine, the system that simulates the effect of cloth through physical calculation can be called the cloth system. It can not only be used to express the fabric effect of characters' clothes, but also can be applied to hair, pendants, etc.

In this project, a mass spring model was used to simulate the cloth, and a lot of cloth decomposition computation time was spent on the process, as the character Azalea was wearing a long dress and long sleeves with a bow on her head. Also, since the clothes are very long, to avoid bugs, the number of collision iterations is adjusted very high, which greatly increases the rendering time.

In the mass-spring model, the cloth is modeled as particles on a mesh, which are connected by spring dampers. Each spring connects two particles and generates a force based on the particle's position and velocity. Particles can be affected by gravity, and springs can be set to different types, such as extension springs, shear springs, and bending springs.

Toon Shader

Wrote script for the cartoon rendering.



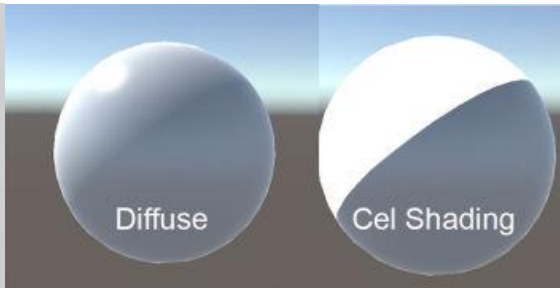
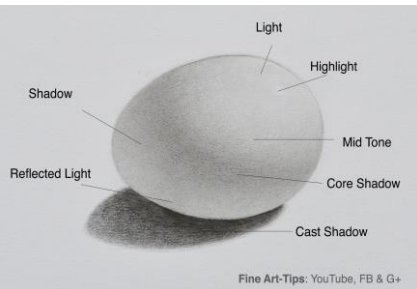
Normal
Shading



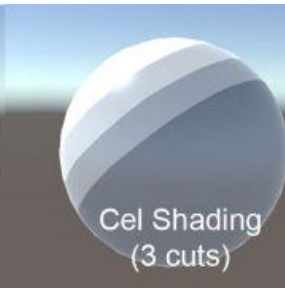
4 Band
Cel Shading



7 Band
Cel Shading



Diffuse



Cel Shading

Cel Shading
(3 cuts)

Grey Model

After constructing the character 3D model, do riggings and applied cloth simulation.



Final Outcomes

A comic-like render output can be achieved. But requires light sources from a specific angle.



Toon Shader

Tried two different cartoon rendering scripts, direct cel-rendering and cartoon texture rendering.



Some Render Outcomes

Fast Track Video: <https://youtu.be/lkQl6BDIV2o>



03 Limitations & Reflections

First Render Test: <https://youtu.be/F1IFcqgHsA>
Final Render Version: <https://youtu.be/OsbE7VH0vi8>



After completing the animation part of the project, I render the project for first time. I found many bugs and problems in the first render, and then spent the remaining half a month rendering the final version while modifying the Maya file. The whole project as an animation is completed. But in fact, the final version still has some limitations.

Animation Flow

First, due to time limitations, there is not enough time to revise the script, modify the storyboard and edit the final animation video. Therefore, some of the plots are not perfect, and some animations have problems with the playback time due to errors in key-frames.

Second, some of the plots are not smoothly connected. And due to technical limitations, some scenes that were difficult to make were deleted. For example, in the railway bridge scene, I wanted to make a effect of blood flowing into the water and emitting a Tai Chi pattern, but did not know how to write the function, so some information that was intended to be conveyed in the original script was lost.



Render Issues

The shader script written by myself is not perfect, so there are many problems.



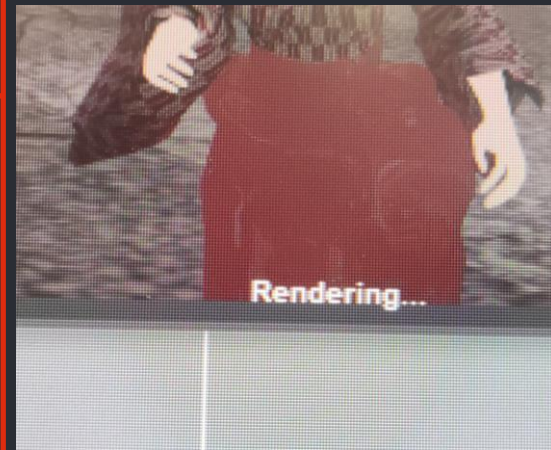
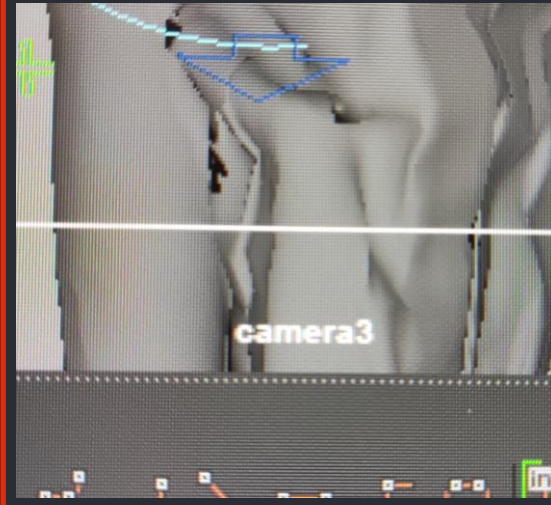
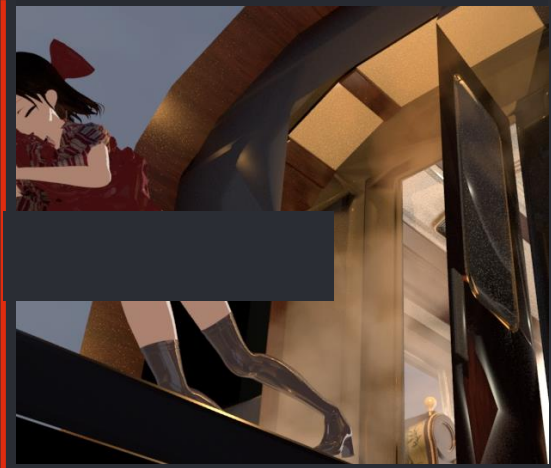
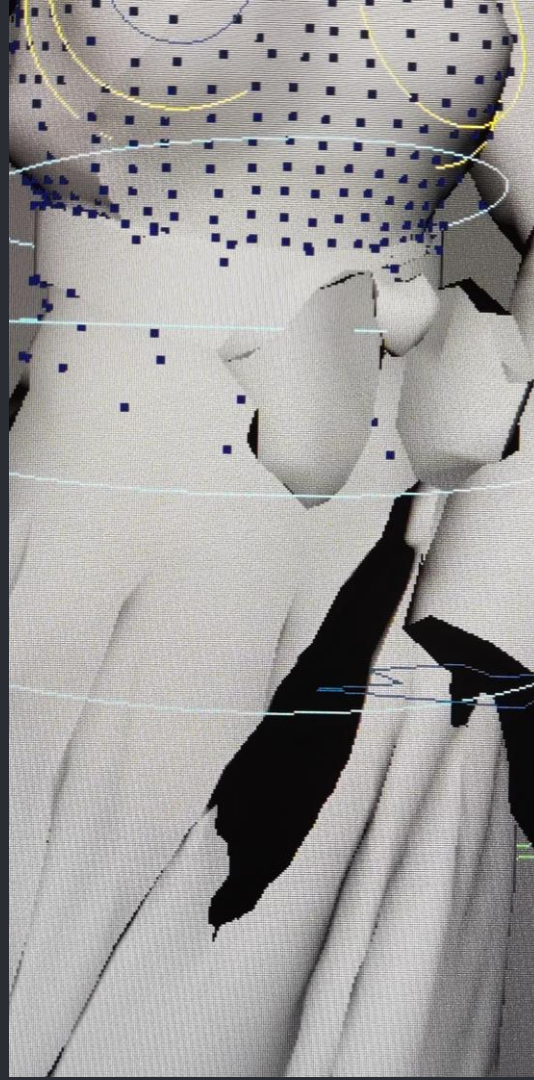
The character is not in harmony with the environment, since the 3D model of the background of the building is more complex, so it tends to look real, but the character itself is cartoon-like.

In some places (especially in dark places) toon shader are not sensitive to light sources and will therefore appear brighter than the environment.

Since the stroke generator is not intelligent enough, all the line edges are the same length and looks strange. I canceled the stroke effect in final rendering.

Cloth Simulation Problems

Since the current cloth calculation algorithm is limited (it's just a normal physics simulation), when the character moves too quick, holes will appear on the clothes or even break. If the collision coefficients are iterated too much, the rendering time will be too long.



04 Conclusion

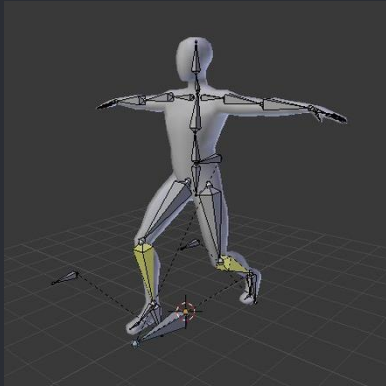
The workload of this project is **extremely heavy**. I started working on it **from May last year** and didn't finish it until May this year. But **I can guarantee that** the concept design, and modeling, including texture mapping, model construction, rigging, as well as scripting, code, scenes, animations, etc., **is all done by myself without any external assistance**.



More than **13000** rendered output images and the maya files are larger **than 50G!**

Future Developments

I found a lot of problems in the production process, while also did research and found some new solutions. But there are some new solutions that I haven't had enough time to implement yet, and I may use them in the future.



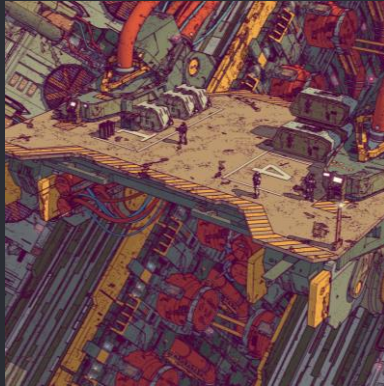
Auto Rigging

Instead of writing the script code for character rigging, using the latest auto rigging technology will save a lot of time.



Motion Capture

Using motion capture makes the character's movements a lot more natural and saves a lot of key frame time.



New Shader

Modify the current toon renderer to make the scene and characters more integrated. And



Cloth Simulation

Use more intelligent cloth simulation scripts instead of simple physics-based calculations to reduce bugs in clothes.



Cartoon Stroke

Make a stroke generation algorithm that transformed according to the viewing angle.



Storyboard

In fact, this animation is a simplified version of one of my previous film script. But in order to simplify, I deleted a lot of important plots, and I hope that one day I can create that full story.

Outcome Videos

Full Animation(Final version):
<https://youtu.be/OsbE7VH0vi8>

Fast Track Video: <https://youtu.be/lkQl6BDIV2o>

First Render Test: <https://youtu.be/F1lFfcqgHsA>

Project Folder:
<https://drive.google.com/drive/folders/1UGKfVtyCHD-SWgQ-lgAme1XZ5Sh2NkPS?usp=sharing>



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Thank you for watching!



Q/A