IG3D REPORT: flames and water animation in Blender through a short film

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I. Introduction

This project is one of the few in IG3D that doesn't rely on any article. The goal was to start from a short story [1] with images like a little graphic novel and to generate it in 3D by using python in Blender. The story is about a little flame boy and a water girl that meet and become friends. Recreating the whole story was a bit ambitious as I've never used Blender before even without the code. But I tried to implement everything I could in python. So, in the end the project is more about modelling a character in blender using python and animating it a little because I realized that it was more interesting to perfect a single character than trying absolutely to do a second one and the animation of the whole story. Therefore, we can see how we can use the code to do the same things using the buttons of the interface. For examples, we can create shapes, use modifiers, selecting specific objects, insert keyframes to animate them, etc. We will detail the range of competences approached in this project.

II. The flame guy character

I concentrated my efforts in doing the flame boy character. For his looks, I gave him a drop shape for the head and a simple ball shape a little flattened on the bottom for the body so the legs don't go too much on the sides but more towards the floor. For both objects, I suppressed the right half of the meshes' vertices to apply a mirror modifier. This is usually done for characters especially humanoid ones because they have a bilateral symmetry. It was a bit complicated to select specific vertices because there are listed in a certain order by Blender. Though, whenever I needed a group of vertices, I used a dichotomic technique to find it in the list. For instance, I selected the first half of the list and not the other one and I watched the result in Edit mode in the 3D View window, and then I refined my search for the group in the list.

From all examples I could find on the Internet ([2] and [3]), most of the characters have only one object for the body so I joined the two body and head objects I created. For the eyes, I wrote a specific function used twice while changing the location of the objects because they are identical. For their appearance, I created a black material that I applied on both of them. Unfortunately, the only thing I couldn't do in code was the fire material applied on the body. I had to do it with the buttons because to create the gradation of yellow/red, I needed the ColorRamp node. In my search for responses, I understood such node doesn't have any equivalent in script.

At first, I tried to do the character with the buttons and then I tried to translate my actions in Python. That's why this part, which I did first, is full of bpy.ops code. But throughout this project, I learned that even if this works, it is often not the easiest way to do things.

Further in the script, there are less and less bpy.ops and I tried to act directly on the objects ([4]).

III. The animation

There are actually two animations in this script. The first one is used to create movement for the flame while the second one makes the character wave at the public. To create the fire aspect, in addition to the fire material, I applied a displace modifier with a "marble" aspect. I then linked its coordinates to an "empty" object so that when I move it, along the z-axis for example, it makes the texture move on the character and that creates a sort of flame movement (Figure 1).
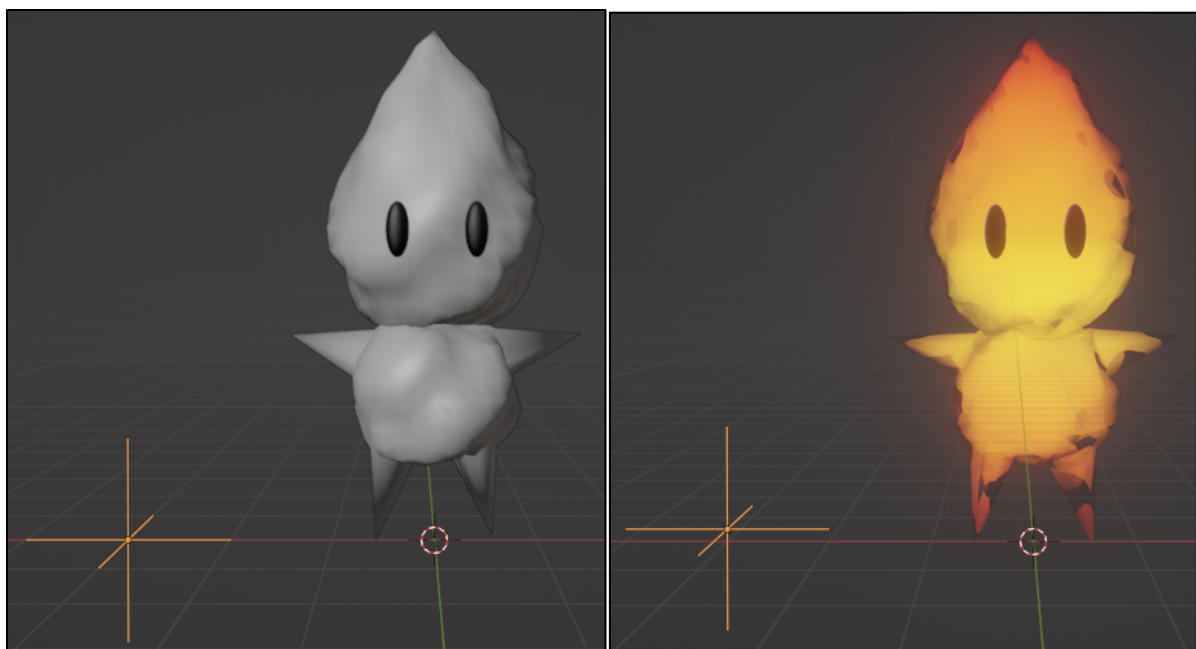

Figure 1: aspect of the character with and without the fire material, the empty object on the left

For the second animation, I also needed a second object: the armature. Once this object is created, there is nothing left to do except adding bones in it. For that, I wrote a function that creates a bone, gives it a name and location for both its head and tail, and gives it a parent bone connected or not depending on the arguments given. The problem I encountered was the connection between the bones. At first, I forgot to do them. The bones seemed perfectly fine until I tried to animate the character. I realized there was only one bone moving while the rest of the structure was immobile. The other problem was the connection between the bones: when one bone is the parent of another one, if connected, the child is always linked by its head to its parent's tail. But when there are not connected, there are supposed to stay away from each other. At least that's what happen when using the buttons. But using python, the head of both bones are automatically located at the same point, so they seem connected even if I want them separated. I couldn't find a solution to that so I just change a little bit the armature especially for the head area where the problem occurred for the eye bones. From what I read and saw, the head bone is supposed to extend to the top of

the head. So, I simply stopped it in the middle of the head's length, approximately at the eye height.

Before applying any animation, there was one more thing to do. When I did some tests on the armature by moving some bones, I realized some movements were deforming the character's shape. To solve this problem, I loop over all the vertices of the affected group and put to 0 the weight of the vertices that were not supposed to influence the movement. For example, all the vertices above the hip height had their weight set to 0 because we are supposed to be able to move our legs without moving our torso.

Finally, to make the wave movement, I created a function that inserts a keyframe for the location, rotation and scale of every bone of an armature. Thus, I could change the rotation of certain bones and I could easily insert the keyframe after placing correctly my character.

IV. Improvement

Concerning the flame guy, there is still one important thing to do. It is creating a movement for its eyes because that's what give it emotions as it doesn't have a proper face or a mouth to smile (Figure 2). Except that, most of blender's aspects has been approached by coding in this project. From now on, it will be easier to create the second character which is the water girl or to animate the scenes. Although, the shape of the water girl is a bit different so the function for the head and the body will be modified. The water material (Figure 3) is already created and it also contains a little animation so it doesn't look static in front of the fire boy: the x location of the mapping node was set to "frame/50" and that adds a movement to the material.
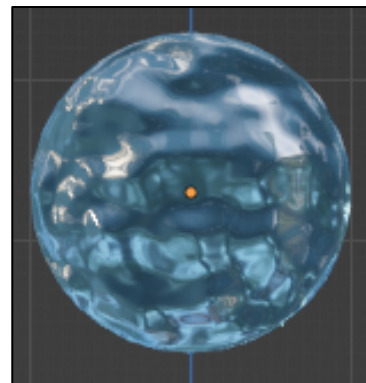
Figure 2: an example of
eye expression, joy

Figure 3: water material
applied on a sphere

V. References

[1] Ingrid Tan. Hold Close. In https://ingridtan.artstation.com/projects/xqAn1, 2009.
[2] https://blender.stackexchange.com
[3] https://studio.blender.org/training/blender-2-8-fundamentals
[4] https://docs.blender.org/api/