# SKELETON CONSTRUCTION AND WEIGHT DISTRIBUTION IN 3D ANIMATION

***O'tkirbekova Madinabonu Ravshanbek qizi***
*Research supervisor:* ***Beknazarova Saida Safibullaevna***
*Tashkent University of Information Technologies, Tashkent, Uzbekistan*
*Email: utkirbekovamadina@gmail.com*

***Abstract****: This article delves into the critical aspects of skeleton construction and weight distribution in 3D animation, emphasizing their significance in achieving realistic character movements. A well-structured skeleton serves as the backbone of any animated figure, allowing for fluid and believable animations.*

***Keywords****: 3D Animation, Skeleton Construction, Weight Distribution, Character Animation, Rigging Techniques*

In the realm of 3D animation, creating lifelike characters that exhibit realistic movements is a complex and nuanced process. Central to this endeavor is the construction of a skeleton, which serves as the foundational framework for any animated figure.

The skeleton consists of interconnected joints and bones that mimic the anatomy of real-life organisms. Each joint allows for specific movements, and the positioning and design of these joints greatly influence how the character interacts with its environment..

*Skeleton Construction.*Skeleton construction is a fundamental aspect of 3D animation that involves creating a digital framework that dictates how a character moves. A well-constructed skeleton is crucial for achieving lifelike animations, as it serves as the basis for defining the character's range of motion and movement dynamics.

*1. Components of a Skeleton.*The primary components of a skeleton include:

- Bones: These are the rigid structures that make up the skeleton. In 3D software, bones are represented as lines or cylinders that can be manipulated to create different poses and movements.

- Joints: Joints connect the bones and allow for movement. Each joint has specific rotational limits, which help define the range of motion for the character. Properly placing and configuring joints is critical to ensuring that movements are fluid and natural.

- Rigging: Rigging is the process of creating a skeleton for a 3D model. It involves assigning bones to different parts of the character's mesh and setting up the hierarchical structure that dictates how movements are transmitted through the model. Rigging can be complex, requiring a deep understanding of both anatomy and animation principles.

*2. Importance of Skeleton Construction.*The skeleton not only facilitates movement but also defines how weight is distributed across the character. When animators design a skeleton, they must consider how the character's movements will affect its overall balance and stability. For instance, a character that performs a jump must have a skeleton that allows for a proper transfer of weight from the feet to the body and head during the action.

*Weight Distribution in the Head Model* .The weight distribution from the head to the character's skeleton forms the foundation of the entire head structure. However, before distributing the weight of any points across the joints, it is necessary to have a skeleton in place.

*Joint Placement* .To distribute weights, you need to create the appropriate joints. For this, select the Skeleton_Joint Tool from the animation menu in Maya. Once the Joint Tool is activated, click once to create a joint, and then click again to create another joint. To finish the joint creation process, press `<Enter>` or

`<Return>`, and the Joint Tool will complete the task.

*Placement of Joints in the Head and Neck.* Figure 1 shows where the joints are specifically located. You should start with the main joint, which will be the parent joint for all other joints. To create the neck joint, simply click in the same spot. Next, click at the point where the head should rotate. This point is located approximately at the angle of the jaw when viewed from the side. Finally, you should add the end joint for the head. Although this is not necessary for any formal reasons, this operation simplifies the selection of the head joint by creating a connecting link between the head joint and the end joint.

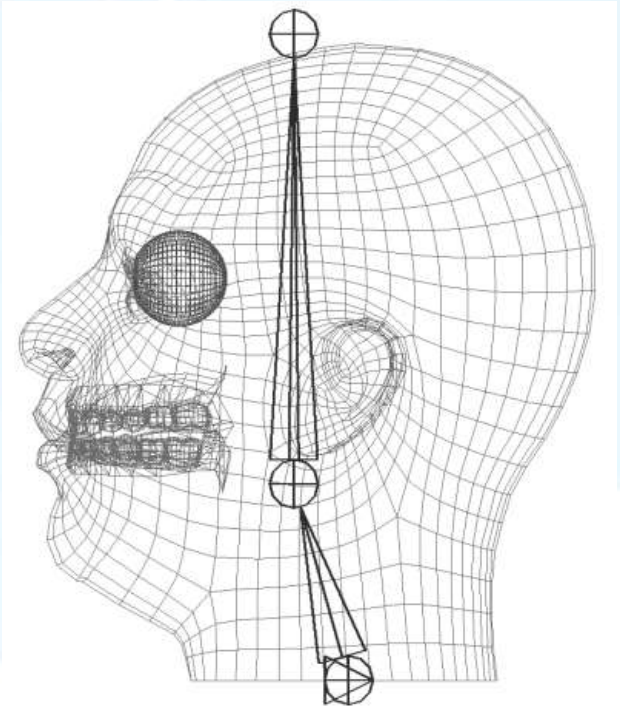

*Figure 1.Placement of Joints in the Head and Neck*

*Placement of Eye Joints.*The placement of eye joints is done with particular care. Even a slight misalignment can cause the eyelids and even the eyes to perform strange movements when the eye joints rotate: eyelids may overlap, and the eyes can pop out of their sockets.Duplicate the end joint of the head and rename the copy to LEye_Joint (Left Eye Joint). Constrain the placement of this joint to the left eyeball, and then delete the constraint node just created in the Hypergraph window, where it is located directly under the LEye_Joint.Next, duplicate this joint twice and rename one copy to LUprLid_Joint (Left Upper Lid Joint) and the other to LLwrLid_Joint (Left Lower Lid Joint).

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