

# 3D Modeling Stylized Characters

Ben Heymann<sup>1</sup> and Felice House<sup>2</sup>

<sup>1</sup>Texas A&M University, College Station; benheyman@tamu.edu

<sup>2</sup>Texas A&M University, College Station; flh93@tamu.edu

## Abstract

In this work, we present a workflow for 3D modeling stylized characters. The analysis provides methodology and information to develop appeal. The process begins with choosing developed concept art that displays accurate anatomy. A blocking stage follows to achieve desired physical form of the character. Further refinements are then applied to obtain anatomical accuracy to enhance character believability. The study also breaks down facial and body features to emphasize key modeling techniques. There is also a focus on construction, or topology of the character. Character models will physically deform along with textures, so topology is critical. Quad-based topology is optimal and ensures the character is ready to move into the next stage of production. These stages work to build an appealing stylized character that is production ready.

## Motivation & Introduction

### Introduction

In this work, we present a stage-by-stage process for building 3D stylized characters. Using this process, we have developed three different stylized characters based on concept art. This methodology allows for an iterative and non-destructive workflow. The stages of 3D character modeling within this methodology are incremental. This allows for an artist to navigate back to any state of the character's development. In animation or gaming pipelines, this is important because creative direction may shift. In the development of this methodology, we have worked with Ryan Tottle, a modeling supervisor from Walt Disney Animation Studios.

### The Workflow

Our workflow consists of the five stages. We first analyse the concept art. Then, we construct base models using quad-meshes to use Catmull-Clark subdivision. We then add details for face and body features. In the last stage, we print the resulted shapes. In the following, we explain each stage in detail.

**Stage 1: Analysing Concept Art and Block-In.** Three different characters were chosen. "Chibi Sailor Moon," based on the concept art of Helen Chen, was the first character. Her dynamic mid-jump-pose inspired me to create this character in 3D. The second character is "Mother Earth," based on the concept art of David Lojaya. The line of action in her pose along with the elegance behind this concept art were our inspiration. The last character was "Chief Bulldog," based on the concept art by Justin Runfola. The grumpy and comedic expression inspired me to create this bulldog character. Character modeling begins with blocking out shapes that make-up the character's profile. They are flexible and meant to achieve general anatomical shapes. These shapes represent forms of the body. This is important because as the character is being developed, the design may change. Using these free-form shapes will allow flexibility for iterative adjustments. The blocking stage marks an efficient time to classify proportions.



Figure 1: *Concept art used for character modeling.*

**Stage 2: Quad-Based Mesh Creation.** Creating mesh topology follows blocking out the character. The blocking process is effective because it is iterative. It allows the shape to develop so edge flow placement in the character's topology can be the strongest. The edge flow in topology is an interlocking series of continuous mesh edges. They control the smoothed form of an animated subdivision surface [4]. With each subdivision, the model becomes smoother. The faces are being multiplied and spaces between each vertex is averaging out. Cycling between different subdivision levels is an effective working strategy [6]. More detail is possible the more divided the model is. The highest subdivision level controls the lowest subdivision level. Any work done in the high-subdivided model results in vertices falling into place.

**Stage 3: Modeling Facial Features.** Across human and animal-based characters, the jawline defines communication and expressions. Underlying musculature is also important to define in facial areas to enhance expression. For example, muscles are responsible for controlling the movement of the eyebrows. When the eyebrows rise, the underlying frontalis muscle pulls the outer lying skin. This creates horizontal wrinkles in the forehead, translating to emotional output from the character. From a stylized perspective these wrinkles are important. For appeal, the definition of the wrinkles should be soft and not too prominent. Before focusing on individual hair strands, it is important to block in a whole shape to define the mass of hair. Areas where hair strands are more apparent, define the active zones. These zones are typically defined with the concept art and can resemble movement. Since hair is lightweight, it will lean or fall in a certain direction due to gravity. It is also important to imply a transition between the forehead and front most hairs for anatomical accuracy. The blocking stage is an excellent time to create the cavity that represents the eye socket. From a stylization perspective, the eyelids need a certain amount of thickness to be present. Defining the tear ducts in the corner of the eye will enhance believability. Adding a slight cross-eye can also make the character more appealing [6]. While animal ear shapes tend to vary, human ears generally all have the same shape. From a stylized perspective, the space within the ear is a defined planar space. Controlling the complexity of shapes within the ear keeps a cleaner aesthetic. However, there are small but important anatomical features to define like the relationship between the tragus and antitragus (Figure 2). Also, tapering in the thickness from the top of the ear down to the earlobe enhances believability. These are some key points to define in the structure of the ear to keep the detail minimal. The minimal detail will direct the eye of the viewer to more important parts of the face. This is essential for appeal so viewers do not get fixated on details. It is more important to clearly read the character's appeal.

Muscles are generally smaller in the head compared to the rest of the body. Yet, they are some of the most important. Facial muscles are communicative tools that work to establish expression and emotion. Showing signs of these underlying muscles on the surface of the model can go a long way. It is defining in selling character emotion and believability. For example, when we smile, the risorius, zygomaticus, and other muscles work to pull back the lips. This creates a fold between the cheek and corner of the mouth. This simple, yet complex action is important. Especially when a character is showing emotion that requires movement of the mouth. The upper lip sits in front and tends to be thinner than the lower lip. It has a more

prominent peak as it curls back towards the mouth [1]. When modeling the mouth, it is effective for the shape to be in a neutral pose to keep symmetry. This can be modified when the expression is set forth. For an appealing stylized look, the lips should have a crease that defines the outline. This should not be sharp. When looking at the face from the profile view certain lines are present. From the nose down to the chin there is a vertical line pointing back towards the body. Even though the face is a whole, each facial feature sits differently on the surface. The top of the nose slopes into our face and requires a smooth transition as it merges into the forehead. The nostril wings are perpendicular to the face, creating crease. Like the lips, defining the crease is important. Keeping the crease softer and less prominent creates more appeal. Adding a visible flat surface across the bridge of the nose adds appeal and structure. That surface runs along the front of the nose as it blends into the face. This subtle definition is not distracting and resembles underlying anatomy.

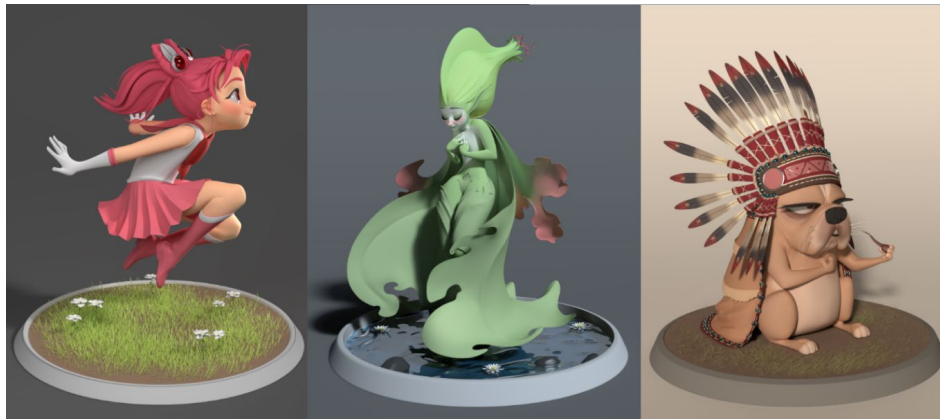


Figure 5: *Final renders of character models.*

**Stage 4: Modeling Body Features.** The human body and most animals have close to symmetrical anatomy. Retaining symmetry will mirror over modeling work from either side, which saves time. It is important to offset features to break away from perfect symmetry towards the end. Bone structure appears at the point of the shoulder, elbow, hands, and part of the wrist. This is important to define in stylized characters. Since stylized animal-based characters have human proportions, the same concepts will apply. Males tend to have more defined musculature on the arm region. It is good practice to show off undulations under the skin for both genders. It is important to keep the hands as simple as possible while defining joints and knuckles. This will keep the aesthetic clean and appealing. Females tend to have softer-looking fingers with more taper down to the fingertip. Males have more prominent knuckles and generally more square fingers. There is a lot of anatomy and complexity within our hands. Finding the balance between simplicity and underlying structure will create character appeal. When analyzing the concept art of a character, there are gender differences in the torso. For example, females tend to have a thicker layer of fatty tissue compared to males. This can affect how much muscle should be showing. From the shoulders to the hips, females tend to have a broader pelvic bone and males tend to have broader shoulders. Females also have more of an hourglass figure because they tend to have a narrower waist. This creates a general contrast. The female usually has a curvier appearance while the male tends to be straighter. Though character designs vary, sticking to base proportions will help sell the model. The legs and feet are another important and intricate part of the body because they support the entire weight. The kneecap, or patella, is an important area to define on a stylized character. The tibia which runs along the front of the lower leg also is important since they do show through the skin. Working with simple geometric forms while refining the shapes will help keep a uniform design. Thinking of the kneecap region as the shape of a triangle, is an example of this. It is close to the actual shape of the patella and is a good start, following refinements to match the concept

art. Since the kneecap represents the area of a joint, it appears more angular. While muscles tend to be more rounded like with the calf on the back part of the lower leg. Simplicity is always a key element for creating appeal in character models.

**Stage 5: Printing Models.** We chose to 3D print the mother earth character model. This presented challenges and a learning experience. Analyzing the form of a character is important when 3D printing. You must incorporate balance in the 3D model, so it is able to stand on its own especially if it is a character. Using pieces as support to help your model balance on its own will work as well. In this case, We used the rocks as base for the cape to rest on and support the entire model. Separating the character into pieces can improve your chances of a successful print. It is important also that your model has no holes in the mesh so the print will be intact. If the model is not watertight, the print will collapse in on itself. Once the pieces were successfully printed and coated in primer, they were glued together (Figure 4). We used super glue to bond the main model to the rocks. The cape was also bonded to the surrounding rocks providing balance for the whole model. The super glue proved to be effective in supporting the pieces together. The pieces of filament in the back side of her hair were extremely small. This made it difficult to bond them to her hair. The physical results were satisfying in representing the 3D form; however, the cost was high.



**Figure 4 :** *Final PVA-based material used for 3D print.*

## References

- [1] Barber, Barrington. *Anatomy for Artist*. Arcturus Holdings, 2018.
- [2] Chen, Helen. "Chibi Sailor Moon" Instagram. Figure 1, Sept. 2, 2019, <https://www.instagram.com/p/BvPHOmVtAQ0n/>
- [3] Lojaya, David. "Mother Earth" Instagram. Figure 1, Oct. 17, 2019, <https://www.instagram.com/p/B0tYcLKH3CL/>
- [4] Niko, Terry. "Modeling for Animation – Body." CGmascot, May 14, 2013, [www.cgmascot.com/design/modeling-for-animation-body/](http://www.cgmascot.com/design/modeling-for-animation-body/).
- [5] Runfola, Justin. "Chief Bulldog" Instagram. Figure 1, Nov. 20, 2019, <https://www.instagram.com/p/BvHT9gjlT0p/>
- [6] Tottle, Ryan. Personal Interview. 25 September 2019.