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Texturing a 3D Character in Hand-painted Style

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<p>This project was carried out to make a comprehensive guide for artists who are seeking to learn the pipeline of creating a 3D character textured in hand-painted style from an initial concept to a fully finished optimized character suitable for games. The aim of this thesis is to present all the necessary information to get an artist started on this path as well as offer theoretical background to this topic, and describe trends that are driving the scene of hand-painted texturing style.</p> <p>The project consisted of a character concepting phase, followed by creating a high-poly model of the character in Zbrush. The model was later retopologized in Topogun to get a low-poly version that is used further in the process and that is suitable for games. Then the model went through technical preparation for the texturing stage. Lastly the character was textured in 3D-coat, a result analysis was done and conclusions were drawn.</p> <p>The outcome of this project is a comprehensive document with valuable information and a game-ready 3D character based the original concept of Sylvanas Windrunner from the World of Warcraft game. The outcome includes a high-poly and a low-poly version and a texture map.</p> <p>This thesis is very useful for artists who are starting out because there is a general lack of information on this topic. The 3D character that was created serves well for portraying all the mentioned theoretical concepts and techniques.</p>	
Keywords	3D, character, hand-painted, texturing, games

Contents

List of Abbreviations

1	Introduction	1
2	Project plan & Character Concept	2
2.1	Project Plan	2
2.2	Concept & References	3
3	Hand-painted Texturing	6
3.1	Comparison to Other Texturing Styles	6
3.2	Hand-painted Texturing Then & Now	8
4	3D model for Texturing	9
4.1	Sculpting the High-poly Version	9
4.2	Retopology & Low-poly Version	16
5	Texturing Process & Methods	19
5.1	UV Mapping & Map Baking	19
5.2	Value Gradient & Patterning	22
5.3	Color & Saturation	24
5.4	Painting the Texture in 3D-Coat	26
6	Project Analysis	33
6.1	Process & Result Analysis	33
6.2	Professional Critique	33
7	The Future of Hand-painted Texturing & Conclusion	35
	References	38

List of Abbreviations

3D Three-dimensional

2D Two-dimensional

UV U and V are the axes in 2D texture

AAA Term used to describe games of the highest quality and budget

Topology The flow/structure of polygons within a model

Retopology Changing the topology of a model, while keeping the same shape. Normally for making a low-poly version of a high-poly model, making it game and animation ready.

1 Introduction

In the games industry there are various types of games that use different styles of texturing, depending on the desired art style and technical nature of the game. Hand-painted texturing style has been around for a long time as part of many games, old and new generation, but there are a few games that instantly come into the spotlight when thinking about hand-painted textures. These are World of Warcraft, League of Legends, Allods Online and Battle Chasers just to name a few.

Online search with keywords such as “hand-painted textures” does not show any books or academic articles dedicated to this topic. The only valuable information on this topic comes from a very limited amount of video tutorials that are out there to purchase and one’s own trial and error learning process. This is also the case with general topics that are related to 3D modelling, texturing or any other section of 3D character or environment creation process. The reason behind this is that videos are a preferable, more effective and more natural way of learning these skills. Therefore this thesis aims to be a comprehensive study as well as a guide and project on its own, to explore and cover the creation process of a hand-painted 3D game character.

Often times figuring out how to get started with this type of 3D character is difficult and confusing. This project demonstrates the process from conception to final texture. It describes the necessary steps and optimal workflow needed to develop an AAA-titled game character.

The main part of this project, to support the theoretical findings, was creating the 3D character from scratch and showing all the progress steps along the way as well as presenting other useful information and images done by the industry professionals.

The goal of this project was to gather the necessary information and to describe the workflow that can serve anyone who is trying to get into hand-painted texturing, in other words, anyone who is interested in learning the texturing style of major games that have permanently affected the industry, in the most positive way imaginable.

2 Project Plan & Character Concept

2.1 Project Plan

The main objective for this project is to create the 3D character in hand-painted texturing style. The character for this project is an existing character from the game World of Warcraft. As the first thing, there is introduction to the topic and background information. Then there is a comparison of past and present artworks in the hand-painted style. That helps to portray how much the style has changed and what are the factors that are affecting the style as well as what are the things that are driving the change.

The next step in this thesis is to explain the modeling process. Specifically the most important things for modeling the high-poly version of the model. The high-poly version is later changed to low-poly model. The process is called retopology, which is also shown with pictures and dedicated software is introduced.

The main part is focused on texturing. Texturing does not mean only painting the texture. The process is far more complicated, and this thesis has a comprehensive break down of the steps. It includes steps such as unwrapping the model, UV mapping and baking maps that are needed in later steps of texturing.

The thesis also describes many important general theories that are essential for most game characters, regardless of texturing style. These include theories of value, color and patterns. Then the part of using a software to paint the actual texture is described in several pivotal steps. At the beginning the character has just the map that was baked, then base colors and eventually defined values, materials separation and detailing to the finished state.

The project concludes with professional critique, which plays a very important role in growing as an artist. It helps the artist to pinpoint their mistakes, see more easily what can be still pushed or what is completely off. The thesis ends with discussing the future of hand-painted texturing style.

2.2 Character Concept & References

Character conception is the stage where the idea of the character design takes on a solid and rather finished state. When starting to learn a new skill or technique it is often advisable to take an already existing design. That helps to remove all the possible design uncertainties and lets the artist focus on what they are currently trying to learn – in this case a specific texturing style. The focus is not to improve concepting skills. Reference is the key. It is highly recommended to use as many references as possible, because it helps to make the process more intuitive [1, 17].

For the project of this thesis, the character is Sylvanas Windrunner, the Banshee Queen. This character already exists in the game World of Warcraft. When designing or working on a certain character, it is important to establish or know the story behind the character. The Sylvanas character in the game's lore used to be a ranger general of the Forsaken. She used to be a high elf. She was later killed, and kept as an undead. She later regained her free will, regained a land for herself and wanted revenge ever since. That is her story in short, but it already helps to establish the feeling this character should give when it is fully done. When this very short story is taken into consideration, the words that best resemble her are darkness, strength, undead, ranger, swiftness, mourn and revenge. These are helpful character traits that help the artist with the creation process, because when the character is done and put to game it has to resemble exactly those words, to match the lore and to be believable. The same idea goes for concepting a character from scratch. Artists often make up a story even if the character is just a portfolio piece and is not necessarily going to be part of any game.

The following figure shows an image collage that compiles most of the images that are utilized to form the design of the character for this project. The design is based on the existing character of Sylvanas but it does not strictly follow it. The reason for that is to form a design that is more modern and better reflects today's approach to game characters.



Figure 1. Reference sheet. Images gathered from DeviantArt (2016) [2].

The reference sheet seen in figure 1 comprises of several images of Sylvanas put together. They are meant to help with inspiration and also guide the color and design choices. In this case, where the character already exists in the game it is very easy to compile references. Searching for different artworks of the character and choosing the most suitable ones is normally sufficient. Only later on in the process, where for example a reference is needed to help with painting a specific material such as cloth or metal, more references might be needed to aid with the painting process.

For cases where the character is designed from scratch the reference sheet would look very different, as shown in figure 2.

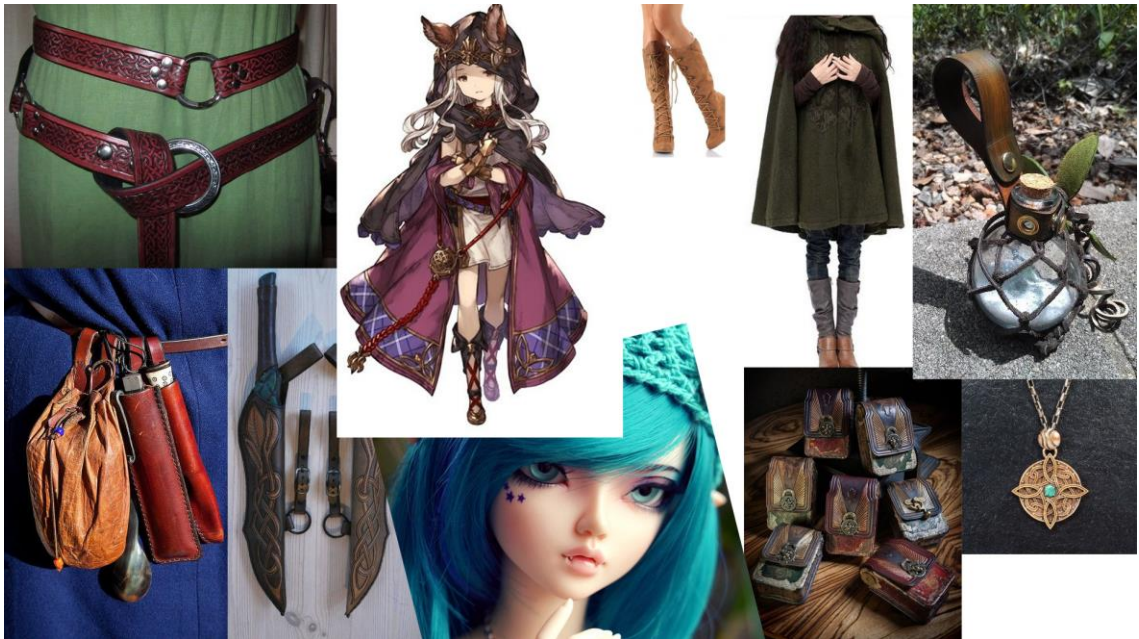


Figure 2. Reference sheet. Images gathered from DeviantArt (2016) [2].

The reference sheet seen in figure 2 comprises of the main character inspiration, which is situated in the middle and surrounded by various elements - photos taken from real world objects. This helps to better depict the important details and transfer them into the digital design that is stylized yet possessing the most significant traits in all its parts, which helps to “sell” the design.

When searching for reference images, it is beneficial to spend a generous amount of time in this preparation stage and reanalyze it several times before moving onto the next stage. A lot depends on the purpose of the character and the amount of freedom the artist has. If the character is meant for a game, then the theme, the scene and many other rules have to be followed. When making a character for a portfolio piece, it depends on what company the artist is trying to get to or what skills the artist wants to practice. However, at all cases it is important that this stage is not overlooked, and that many comparisons and different designs are explored before calling the design ready and proceeding to modelling stage.

3 Hand-painted Texturing

Hand-painted stylized textures are really something that game studios are starting to embrace as a stylistic choice. In a nutshell what hand-painted texturing means, is that the use of normal maps, specular or other secondary color maps is non-existent. The model is painted directly, in a traditional digital painting method. The outcome is a single diffuse (color) map.

The games that use this style of texturing are normally stylized, non-realistic games such as World of Warcraft. This style would not be found in any games with a more realistic style of art, such as Battlefield or Assassin's Creed.

3.1 Difference From Other Texturing Styles

The main difference between hand-painted style and other texturing styles, is the overall artistic style and expression that comes from the finished character, prop or environment. Hand-painted textures are often related to the fantasy world, as opposed to realistic texturing approach, in which the games better reflect the real world. The figures below show the difference between these two styles.



Figure 3. Gun in hand-painted style [3].

Figure 3 shows a stylized gun textured in hand-painted style. Only major and the most important details are portrayed. The following figure can be compared to figure 3 to better understand this concept.



Figure 4. Gun in realistic style [4].

This gun has a lot more details, to better resemble a real world gun. This looks significantly more complicated and heavy as opposed to the hand-painted gun, which appears more simplistic and fantasy.

Another major difference is what types of texture maps are used. Most other texturing styles will utilize at least two maps. For example these are normal, displacement, specular, light map or other. Those are then built together to one map in software such as Photoshop for final render of the character (if it is for presentation purposes only) or processed by a game engine (if it is part of a game).

With hand-painted style, all the lighting and shading information comes from one map, meaning all this information is painted into the texture map by hand. Sometimes an ambient occlusion map is used as a base to start the process. This is explained more in depth in chapter 5.

3.2 Hand-painted Texturing Then & Now

As anything else, the way textures are painted today has changed considerably. In the past hand-painted textures appeared more grungy, dirty and busy (eyes had hard time finding the point of focus). Nowadays they look revamped, because a more simplistic approach is taken and the things that happen within a model are more organized. Figure 5 shows a perfect example of that.



Figure 5. Comparison of old and new texture of a League of Legends character [5].

There are many things that can be discussed regarding this picture. To break it down, firstly let us look at the values (the range of lightness and darkness of a color) of this character. With the old version, the viewer's eyes do not know what to focus on, especially considering this game is played from a semi top-down view. That means the focus should be at the upper level of the character. The range of values is out of place in the old version – his feet have as light parts as the top of him – his head. This is fixed in the new version, in which the darkest areas are at his feet and lightest at his head.

Another issue is blown-out colors. The old version is highly contrastive. The dark parts of the texture are too dark and the parts that are supposed to be light are over exposed. In the new version, the values are balanced and less contrasted.

Last but not least, in the updated version the colors are more muted, less saturated and the details such as his fur or his armor are softer, less crispy. Together all these things immensely add to the overall readability and clarity of the character in the game as well as making it look more modern.

4 3D Model for Texturing

3D modelling can be described as “the process of creating a mathematical representation of a three-dimensional shape of an object” [6,4]. It is a fundamental part of any 3D related production and most CG productions. With 3D software and appropriate techniques, any desired object or environment can be modeled, using digital space and its dimensions (x, y, and z).

Polygons are the building blocks for all 3D models. A modeller usually starts building a base mesh and then proceeds with adding details. This varies greatly, depending on the final purpose of the model. For example there is a tremendous difference in polygon density between a model intended for a game, which normally is very light in polygon count, compared to a model used for cinematic production, which has a high polygon count to retain all the details. [7, 25].

4.1 Sculpting the High-poly Version

In most situations when creating models for a specific game, there are certain factors that need to be considered, even for an experienced modeller. That is because each game might use a different game engine or overall a different technical approach, so-called pipeline. Some of the things to consider before starting the modeling process are the silhouette and the accessories. The silhouette must be easily identifiable at the first glance and show the orientation of the model. Characters are always designed with pose in mind. The pose should reinforce the character’s strength, demeanor, and speed. Accessories, such as weapons, pouches or flasks also need a unique read but should work to complement the character’s design. [8,2.] The following figure shows an example of a character’s silhouette demonstrating the above mentioned theories.

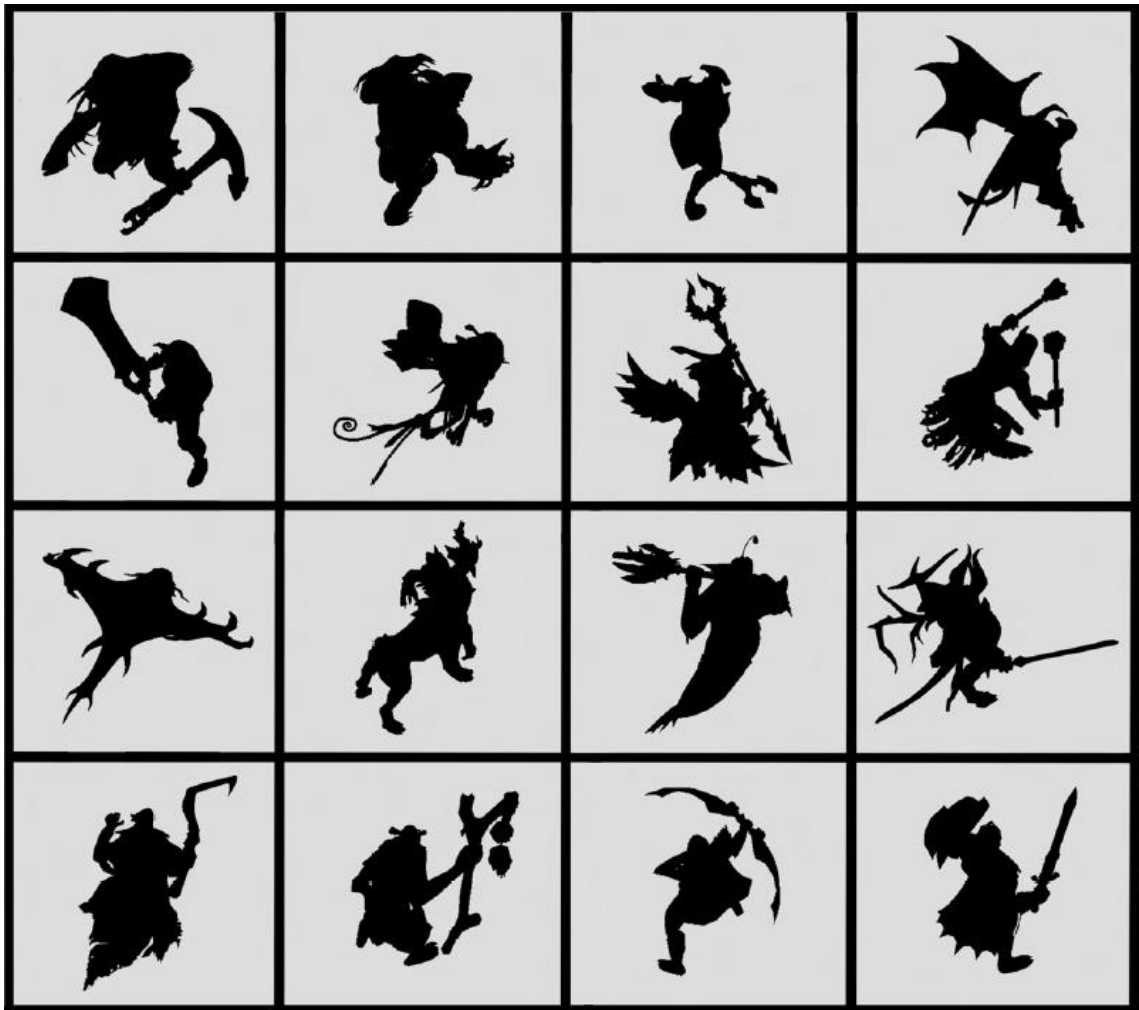


Figure 6. Character silhouette [8,2].

In this case, the model is created for the sole purpose of this project. It is always good to practice and implement these essential rules, even if it might not seem necessary, as it will never end up in and an actual game. The model is modelled in a standard T-shaped pose but at the last stage of the creation process it may be posed, for presentation purposes. That is another reason why this rule is taken into the consideration when modelling Sylvanas, eventhough she will not be implemented in a game.

Starting out with the model, the options are either to create the base mesh with software such as Maya, building polygon by polygon, or the often preferred and faster way using Zspheres in Zbrush. Zbrush is a software that works for digital sculpting and painting [9].

In this case, Zbrush is used for almost the entire modeling process. Zpheres are a feature in Zbrush that allows users to quickly build shapes, stacking spheres onto one another

or pulling them from one another and then converting the shape to polygonal mesh. After some tweaking the model should look close to what can be seen in figure 7.

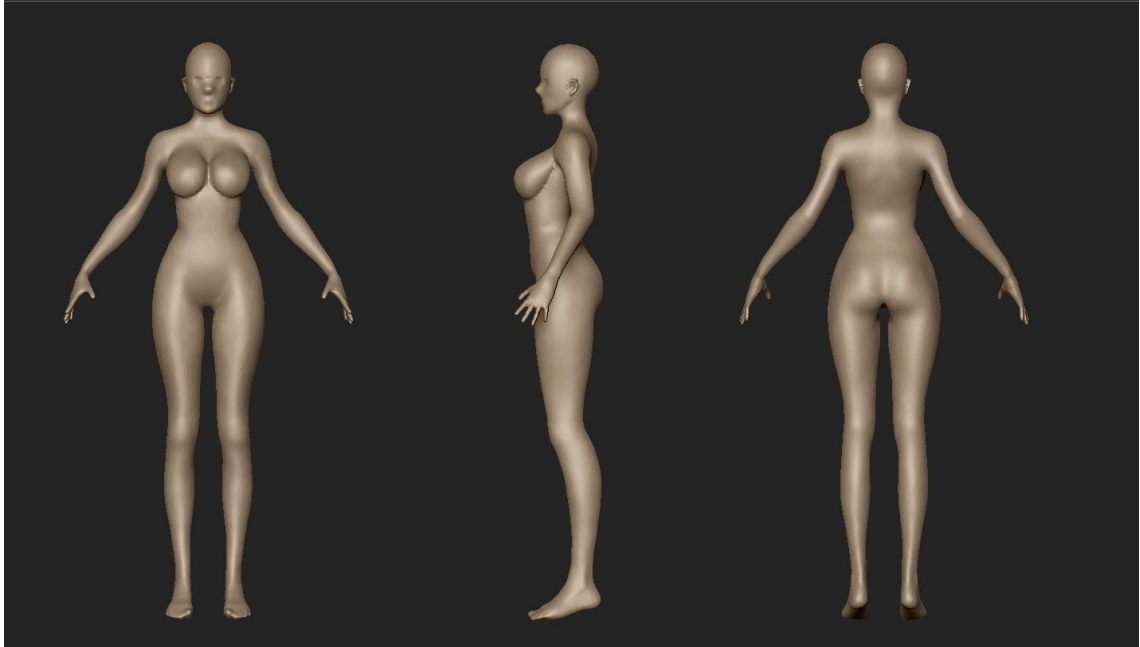


Figure 7. Sylvanas base mesh.

At this point the model needs many hours of sculpting – pushing, pulling, moving and carving. It is a process of refinement. It involves working several minutes on each section and repeating on a constant loop, until the artist is satisfied with the result. It is very important to make this anatomically correct. Figure 8 shows anatomical reference for the body parts of this model.

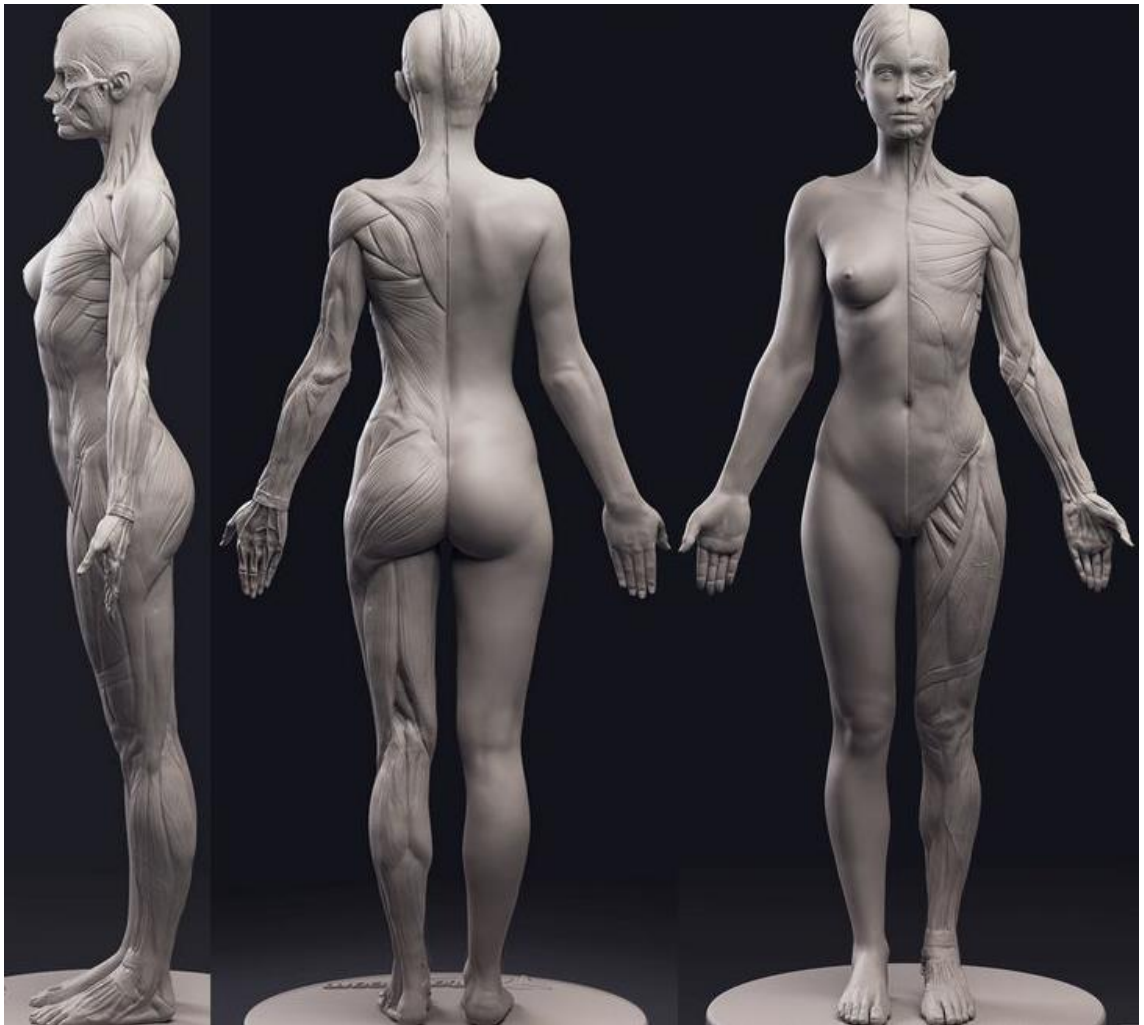


Figure 8. Female anatomy reference [10].

To make the model look believable and professional, it is important to put strong emphasis on sculpting in accordance with anatomical reference. Of course, usually with games there is a certain amount of stylization happening, therefore such anatomical reference serves as a reference to depict the most important landmarks; such as hip bones, waist area and overall soft curves. With females it is important to not overdo any section and not add too much muscle definition because very easily the model can start looking like a male. Less is really more. It is crucial to be constantly looking at the sculpture from every angle and zooming out the viewport as this helps find the problem areas or incorrect forms. [11, 32-37.]

Zbrush is great at detailing the surface to micro levels, but form should always be the primary concern when modeling. Many artist quickly jump into detailing which leads to overlooking the importance of properly establishing the form and structure of the character. [12,4.]

The Sylvanas character is supposed to look more stylized, as that is the way characters normally are in games. Figure 9 shows another reference that is used in the modeling process.



Figure 9. Stylized female anatomy reference [13].

The anatomy of the female character in figure 9 was chosen to follow for this project, regardless of the fact that it already has clothing and an armor, because the proportions are still easily readable. In comparison to the previous figure, this character has noticeably longer legs, bigger head and other exaggerated proportions and shapes. This helps to make Sylvanas look more like a game character and not like a realistic female character.

For the head and face reference, the artist needs to decide what kind of expression they want the character to have. In this project the story and personality of Sylvanas was established in the earlier section of the thesis. For the specific face design, referring to the original character concept is sufficient. However to help with modeling it, figure 10 shows anatomical reference that depicts the planar landmarks on female face.



Figure 10. Female face anatomy reference [14].

The reference helps tremendously in very early stages of modeling the face. It helps establish the basic shapes, and then personalizing the face to look a certain way is much easier from that point. If necessary it is advisable to search for more references when struggling with a certain area and observe properly. If possible, asking for feedback from professionals can be extremely helpful. Figure 11 shows a paint-over of Sylvanas's face in the early stages of modeling. During a struggle phase a fellow friend with fresh pair of eyes was able to help.

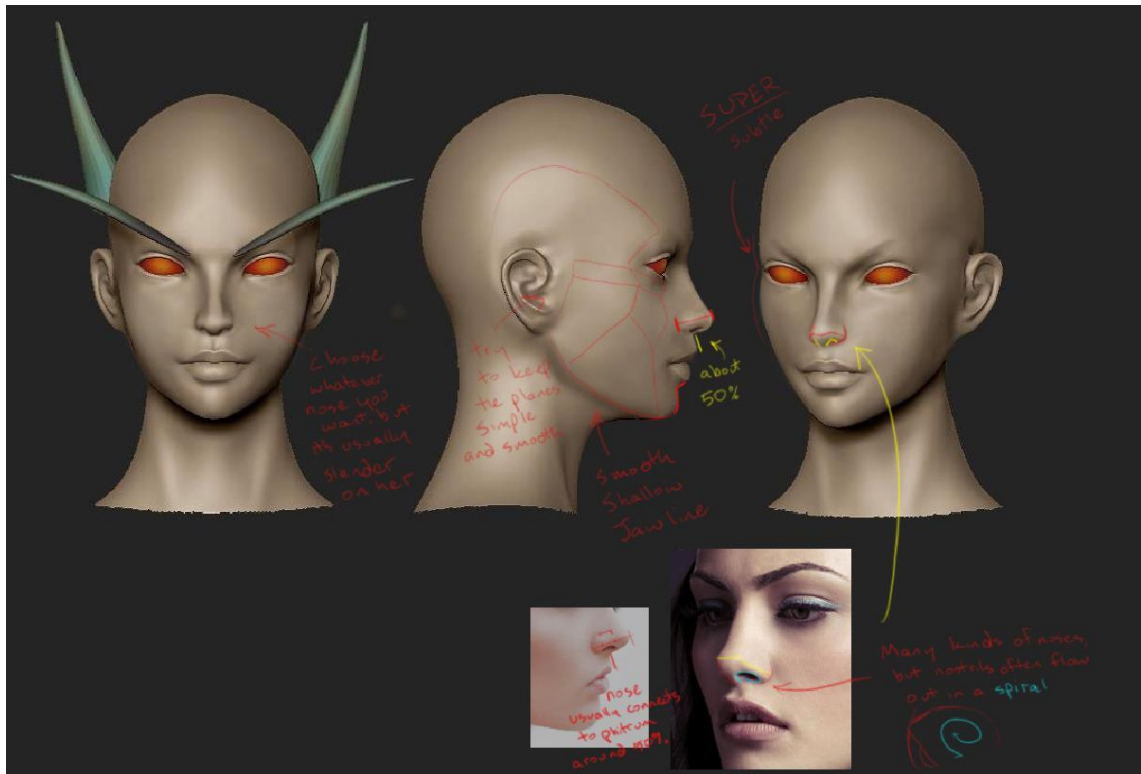


Figure 11. Paint-over of problematic face areas.

This paint-over really helps to see what the issues with the model are and fixing them was rather easy afterwards. Figure 11 points at the anatomical issues with the nose and the jaw. The paint-over suggests a smoother jaw curve and to angle the nose and upper lip area in different angle compared to the original, referring to realistic female photos.

Another important note is to work on all hard-surface armor areas (such as shoulder parts, breastplate, and leg armor) in Maya, because in Zbrush creating clean hard-surfaces is very ineffective and creating them in Maya proves much faster. The next figure shows the finished model of Sylvanas, including armor parts that were done in Maya.



Figure 12. Final high-poly sculpt of Sylvanas.

This is a high-poly version of the model, meaning it is made of millions of polygons at this point. All the details are defined by polygons, and in this state the model is not suitable for any game, as it is too dense and too heavy for any game engine to handle.

4.2 Retopology & Low-poly Version

When the high-poly version of the model is done, the next step to take is retopology. This provides the artist with game resolution low-poly 3D model. In this process, the topology (the flow of polygons within a model) is changed in such a way that the general shapes of the model and its parts stay the same but the polygon count is significantly lower. This can be done using software such as Topogun. [15.]

Each object that makes up the whole model is retopologized separately, which means face, cloak, boot, strap, spike, skull and so forth. New topology is drawn on top of the surface of the original high-poly object. Figure 13 shows the low-poly version of Sylvanas.

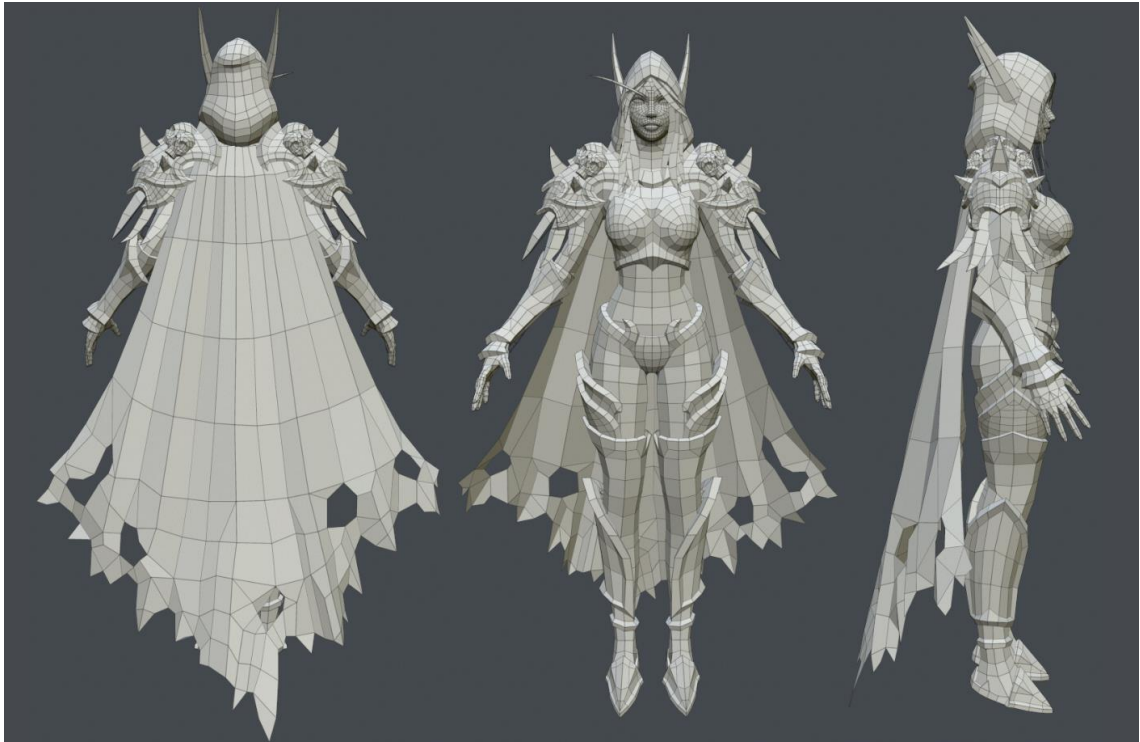


Figure 13. Final low-poly model of Sylvanas.

The model of Sylvanas is now approximately 11,000 triangles ($\approx 5,500$ polygons), down from around 4 million polygons in its high-poly version. Only the most important shapes are kept. The model was already modeled considering that many armor details will be drawn in the texturing process. Therefore there are not extra details on the armor parts, for example. Taking a look at the original reference sheet there are many patterns and details on her armor or hood which were not modeled at all. The idea behind that is better explained in chapter 5.

Already in this stage of the whole process, the approach of applying a value gradient should be followed. This goes for both models and textures. Value gradient is understood as the range of lightness and darkness within a subject, regardless of color and saturation. Applying gradient in the modelling stage means the highest amount of polygons around the upper torso area and head and proceeding to the bottom parts with fewer and fewer polygons, which means that more details are concentrated at the upper parts and fewer details towards the lower parts of a character. [8,15.] This approach can be observed in figure 14 figure as well as figure 13.



Figure 14. Final low-poly model of Sylvanas, topology gradient – close up.

Figure 13 and 14 show the geometry gradient – there is more geometry at the parts where it is more important to show details, in this case the face area. In general, the area which contains the most detail is the upper body.

There are a few practices to keep in mind when building the low-poly model. Every polygon needs to have its purpose (an average character has around 8,000 polygons), either contributing to the silhouette and/or helping deformations (for animation). Long polygons should be avoided because they might cause shading errors, especially during animations - that is when the geometry deforms. [8,15.]

5 Texturing Process & Methods

Texturing is the process of applying a 2D texture map onto a 3D model in order to add color and detail information to it [16,12]. The procedure depends on the texturing style of choice. It can be as little as one texture required to create an appealing and believable character – a diffuse/color map, or combining multiple textures for more realistic style, such as normal, specular or cavity map.

5.1 UV Mapping and Map Baking

UV mapping is the process of creating a 2D representation of the model. It is the pattern by which 2D texture is projected onto the model. To create a UV map, the model first has to be unwrapped. This means making seams and cutting the model according to the seams that were defined, which results in several pieces of the model, called islands, placed on 0 to 1 UV space. [17,47.]

The UV map also needs to be optimized. There are several things to keep in mind. UVs should be mirrored as much as possible. This means objects that are symmetric can be flipped and stacked on the same UV island. Only the most prominent parts should be asymmetric and thus not mirrored. Face UVs should take up at least 25% of the body's UVs so that sufficient detail is retained. Eyes should be on a separate UV island, not together with the face.

UVs also typically have a density gradient with the lowest amount of UV space towards the lower body and largest UV space towards the head. A general rule for making optimized UVs is to waste as little space as possible, but also not putting UV islands too close to one another. It is recommended to always leave 5-10 pixels between each island. [8,17.] The finished UV map of Sylvanas can be seen in figure 15.

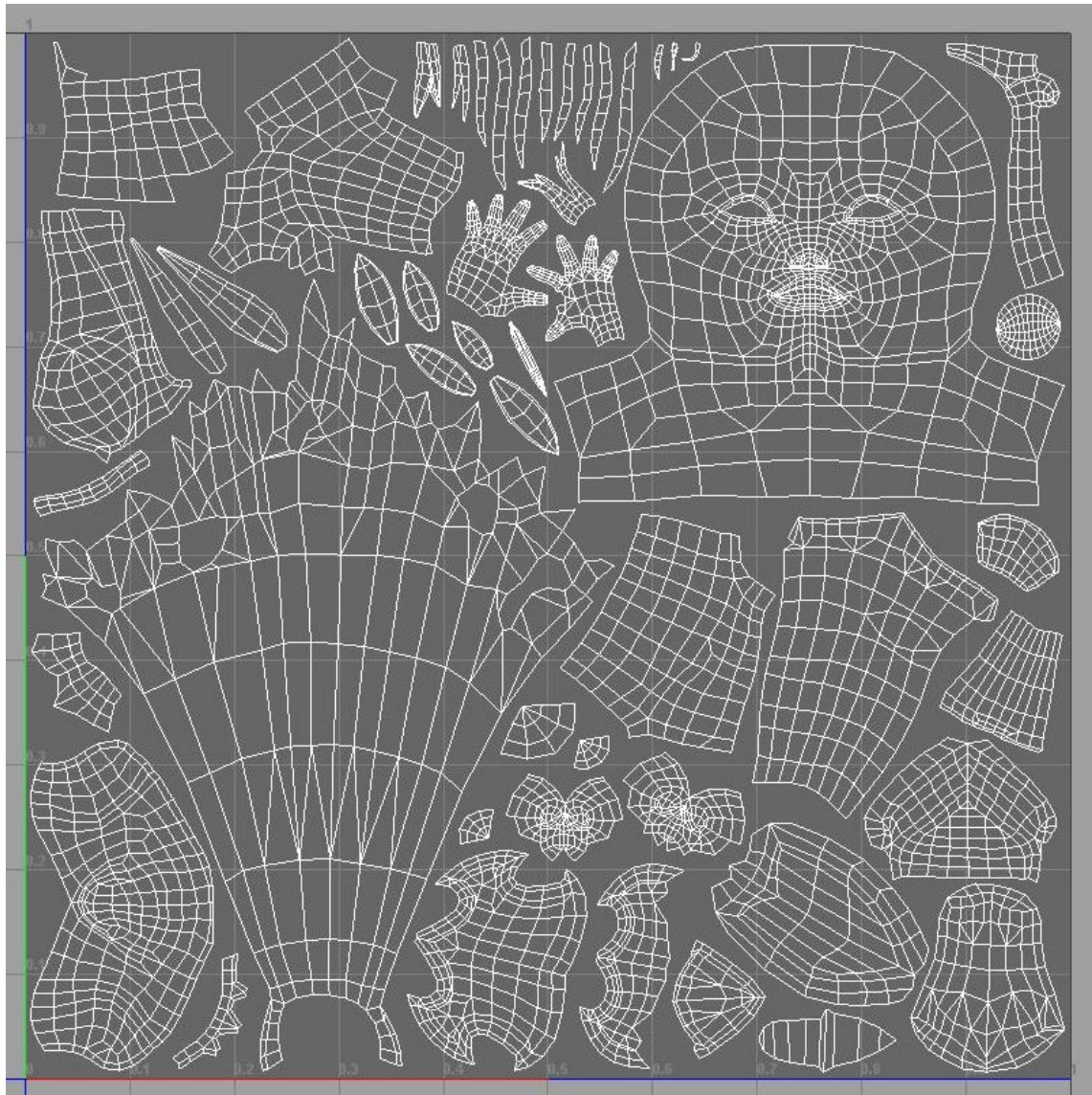


Figure 15. UV map of Sylvanas.

This figure shows how most of the symmetric objects of the Sylvanas model are mirrored. Those are for example eyeball, shoulder armor, hands or feathers. They appear on the map only once, even-though there are two hands in the model. The cloak is not mirrored because there are asymmetric areas in it. This is one of the most important technique to optimize UV texture space.

For a further texturing process, it can be helpful to bake (create) an ambient occlusion map. Such a map contains the shading information captured from the high-poly model. That is another reason why it is useful to have the high-poly version. It really helps to get the low-poly version to look more like the high-poly version and to speed up the texturing process slightly. Ambient occlusion can be baked in a few different ways, either in the sculpting software that was used for modeling -- ZBrush, where it is rather automatic, but does not give very good results, or another software such as Topogun, where the high-poly model objects need to be imported as a reference, one by one. Topogun gives much better bakes (which are more accurate and have fewer artefacts). The map is laid out according to the same UV pattern. The figure below shows the low-poly version of Sylvanas (that is the only version that is being used during this stage) with the ambient occlusion map on top.



Figure 16. Sylvanas with ambient occlusion map.

The ambient occlusion map bake is usually not perfect. There are normally some artefacts, which is normal. They can easily be fixed in Photoshop, 3D-Coat or other similar software. The most important information is captured. The shadows, the highlights and all the details that were sculpted in the high-poly version now appear on the low-poly version. These details come only from the ambient occlusion map. There is no actual geometry for the details. Now Sylvanas is ready to be painted on, but first it is important to mention a few rules and theories.

5.2 Value Gradient and Patterning

As explained on page 17, a value gradient has to be added to the texture in order to create an appealing and readable character. The importance of the value gradient is often considered greater than the importance of the color. As it is used to not only create focal points, it also creates the illusion of depth and helps give three-dimensionality to the object. The character value should shift from the darkest at the lower body to the lightest at the upper body. This helps to draw the player's eye to the most important areas of the character. [8,3.] Figure 17 demonstrates this theory.



Figure 17. Value gradient applied to various characters [8,3].

The figure shows how the characters are the lightest at the top and the darkest at the bottom areas. This theory is something to keep in mind during the painting process and it is important to keep checking for it as the texture painting progresses because sometimes it can get ruined as the details are added.

People's eyes instinctively look for boundaries between areas of contrast. [8,2.] Therefore, it is important to establish contrasting blocks of value in order to highlight the different forms for the character. Following the theory of value gradient, the character should have more visual interest at the upper body and head. That can be achieved by increasing the value contrast among objects in that area and keeping the objects of lower body with less contrast. Figure 18 shows how this theory is applied, focusing on the upper parts of the character.

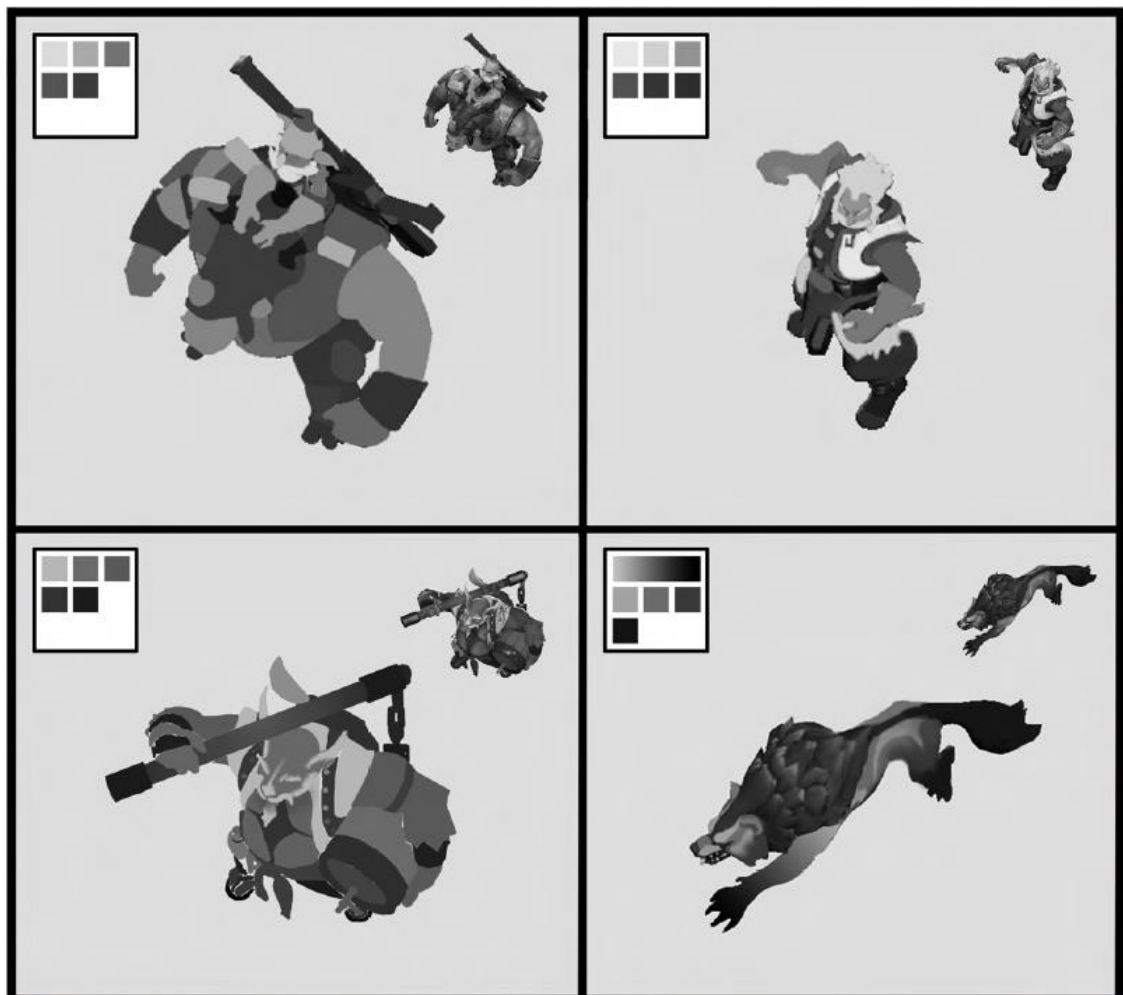


Figure 18. Value patterning – drawing visual interest [8,4].

5.3 Color and Saturation

When designing the color scheme for any character it helps to follow a few basic rules about colors. It is advisable to first choose the primary color that best represents the character, and then select a secondary and tertiary color, either by using complementary, split complementary, analogous or triad color schemes. During the color texture painting, only the blends of these main colors should be used, in a harmonious way. Primary solid colors, such as red, green and blue, or colors that are dominant in the world should be avoided. [8,5.] Figure 19 shows how color schemes work. It also explains how they can be combined to maintain harmony. Once the source colors are picked, to derive a full palette, these main colors can be mixed, shaded and/or tinted.

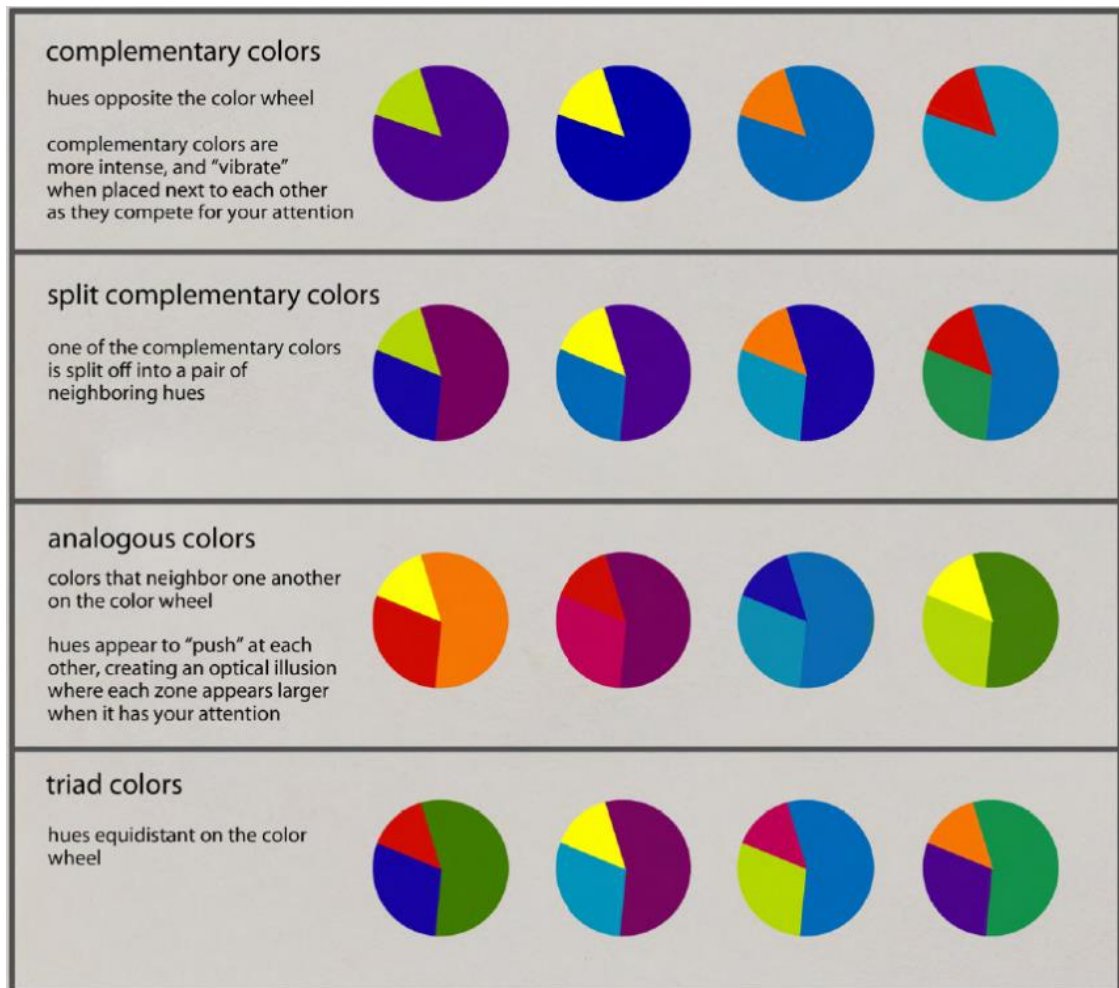


Figure 19. Color scheme [8,6].

Saturation (the intensity of the color) also draws the eye, which means the value gradient should be taken into considerations in regard to saturation as well. Primary solid colors of maximum saturation, such as red, green and blue or colors that are dominant in the world, should be avoided. In order to boost the visual interest in the overall character, it is good to choose very small areas and use colors of high saturation. In figure 20, the use of color schemes can be seen as well as value gradients applied in all aspects that have been discussed so far. The figure also shows a small area of high saturated colors. Especially on the last character, his eyes are a good example. [8,5.]



Figure 20. Color scheme [8,5].

To properly understand these few principles, it is best to see a side by side comparison, shown in figure 21. On the left side the character does not follow these principles. There is a clear difference in the version of the same character that is on the right.

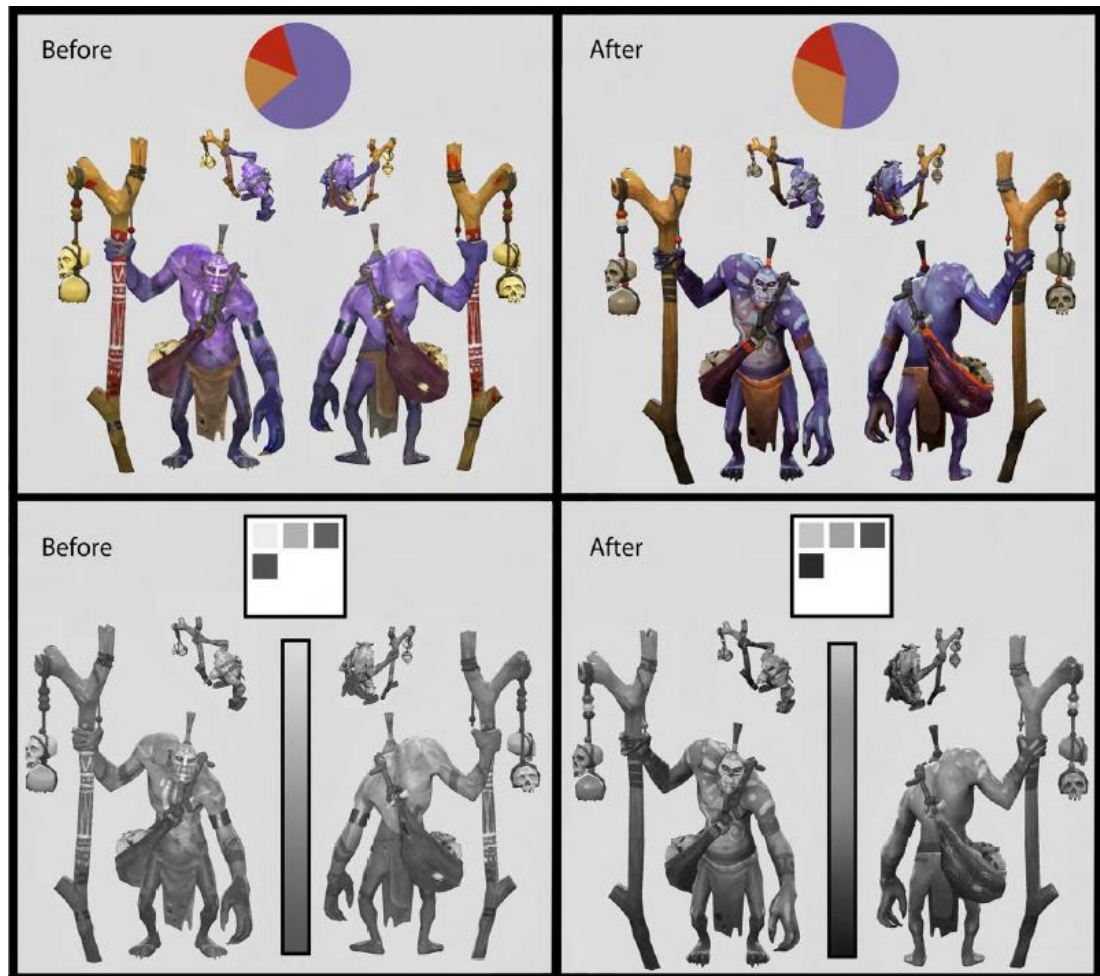


Figure 21. Value and color principles - comparison [8,11].

The character on the right has been redesigned using the principles of value gradient in terms of geometry, color, saturation, details and contrast (which means all the above mentioned concepts).

5.4 Painting the Texture in 3D-Coat

The essential principles of character texture painting have been explained now as well as technical preparation of 3D models for texturing. This section helps with painting the texture inside a dedicated software called 3D-Coat. The section however is not meant to teach how to use the software, but it is meant to demonstrate the process and mention a few tips.

Once the Sylvanas model is imported to 3D-Coat, with her ambient occlusion map (AO map) as a separate image layer, as shown in figure 16, the next step is to fix up the artefacts on the map. Painting over the small black spots to remove them is usually sufficient. If the map is slightly too dark, levels in Photoshop are a quick fix. The layers from 3D-Coat can be easily opened in Photoshop with "Ctrl+P" shortcut and re-opened in 3D Coat with updated changes.

The brushes that are used for this texture are pictured in figure 22. What works for one artist might work as well for another one. The brush settings are optional but this is what worked well when painting the texture of Sylvanas.

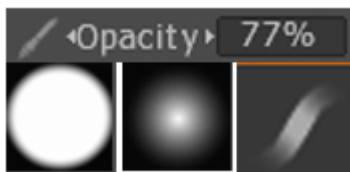


Figure 22. Brush, stroke and opacity settings in 3D-Coat.

The first and most used brush is a classic hard-edge brush. It is used for majority of the work. The second brush is a classic airbrush, used for glows, diffuses, minor adjustments of value and so forth. The last icon shows which stroke setting to use with these brushes. The opacity varies a lot. Sylvanas is painted with brushes of 65-95 % opacity.

The above steps are followed by painting Sylvanas with base colors. It is better to start with darker colors, even if they seem too dark, as they probably are not. That is because the desired value will be built up later and this way it is easier to give it more depth in the end.

In this case Sylvanas was painted on top of her ambient occlusion map layer. In many cases people put the AO map on multiply blending mode and leave it on top of the layer stack, which means that it will always show through, since it is the layer on top of everything else. This is in a way restricting. That is why the Sylvanas texture was painted on top of the AO layer, which means that anything painted on the layers on top of the AO will cover it up. That gives freedom for doing possible design changes later on. For example if there was a circle detail on her armor before, coming from the AO map, this way it can be painted over to be a square. So in such case the AO acts more like initial help and guide to paint further on. If the AO map stayed on top of the layer stack (in multiply

blending mode), the circle would stay on the armor without the artist having any way of changing it, but perhaps the artist would feel more secure about managing to paint the rest of the texture.

The next step is to add large details, to bring back the lost sculptural detail. The depth can be added to the model by painting lighter strokes alongside the large darker shadows. That varies depending on the material and object type. This means painting in the form.

Form is among the primary concerns when it comes to texturing. Developing the form of the object and making sure it is done correctly is more important than the details in that object. In terms of painting the texture, form can be understood as directly applying light and shadow. Without shadow there is no form. [12,4.]

The next step to take, in general, is to take the base color of whichever part is being painted, make the color brighter and/or more saturated and paint in rather random places within that object/area. Blending these strokes well into the base is the key. These newly added colors need to feel integrated. Painting around them with the initial base color and color picking surrounding colors is the best way to get a nice painterly blend. After that, several brighter highlights should be added, also making sure that they are blended into the base.

Then the artist can proceed by taking the base color again, but going darker to add micro detail landmarks and blending them into base the same way. Here it is important to not overdo it with details and also not make the details too small, so small that they would be unreadable when zoomed out. Figure 23 shows what Sylvanas looks like after all the steps that have been taken so far.



Figure 23. Sylvanas texture – initial to mid phase.

Some areas of her texture are more developed than others, which is normal, but in general it is best to spend time developing all areas in loops. It is advisable to work a little bit on each part, but not to bring each section to the final state. Sylvanas at this point is still quite dark and materials are not well readable.

To push materials to look believable, it is recommended to check real life reference. For example her armor, – particularly the metal parts, should be shinier, whereas the skulls

or spikes are made of completely different material. Therefore they do not have much specularity. It is also important to be always thinking about the light source, which in this case is established to be top-down. It affects where the highlights are placed and how they curve. Material definition is yet another important concept to keep in mind when painting. If something is made of wood, it has to be treated like wood. If there is a linen fabric and leather next to each other, they need to be differentiated from one another.

To further enhance the Sylvanas texture, this is a good point to check how her values are, or if some colors can be balanced out. Also to make everything more believable and give it that nice painterly feel, which is signature for hand-painted texturing style, the Sylvanas objects need to receive some treatment for surface details, which can be done by color picking a neighboring object and painting with the color on the object next to it. The next figure demonstrates this process.



Figure 24. Sylvanas texture – adding surface details, example 1.

This is a part of her breastplate. Firstly, the purple area has different shades of purple distributed around and blended into the base. Some damage landmarks are shown on the silver part. The redness comes from her red cloak which is the closest thing to this

armor piece. The breastplate, being made of metal, catches some of the red from the cloak. Lastly, the purple is spread slightly over to the silver part of the rim. The same technique is applied across the entire Sylvanas model. The figure below shows another close up to demonstrate this concept.



Figure 25. Sylvanas texture – adding surface details, example 2.

All areas of the model need to receive the same treatment respective to their nature. The skulls on the shoulder armor have received a bit of blue from the armor. Her under-eye area has received the orange from her glowing eyes. Also the highlights on upper parts of her hair are stronger than the bottom hair, all according to the previously discussed principles and concepts.

It is very important to constantly go back and forth between these steps, as along the way certain steps can get drowned out, being aware of value, readability and material definition. Also making sure to not overdo the micro details and to not over exaggerate the values is essential. Always zooming out and looking at the model from far away helps to notice if at some point of the process this happened.

Adding more color variations, bumping up the saturation levels in certain areas, or exaggerating depth with overlay layers are some of the final steps taken to finish the Sylvanas texture. The figure below shows the final picture of Sylvanas.

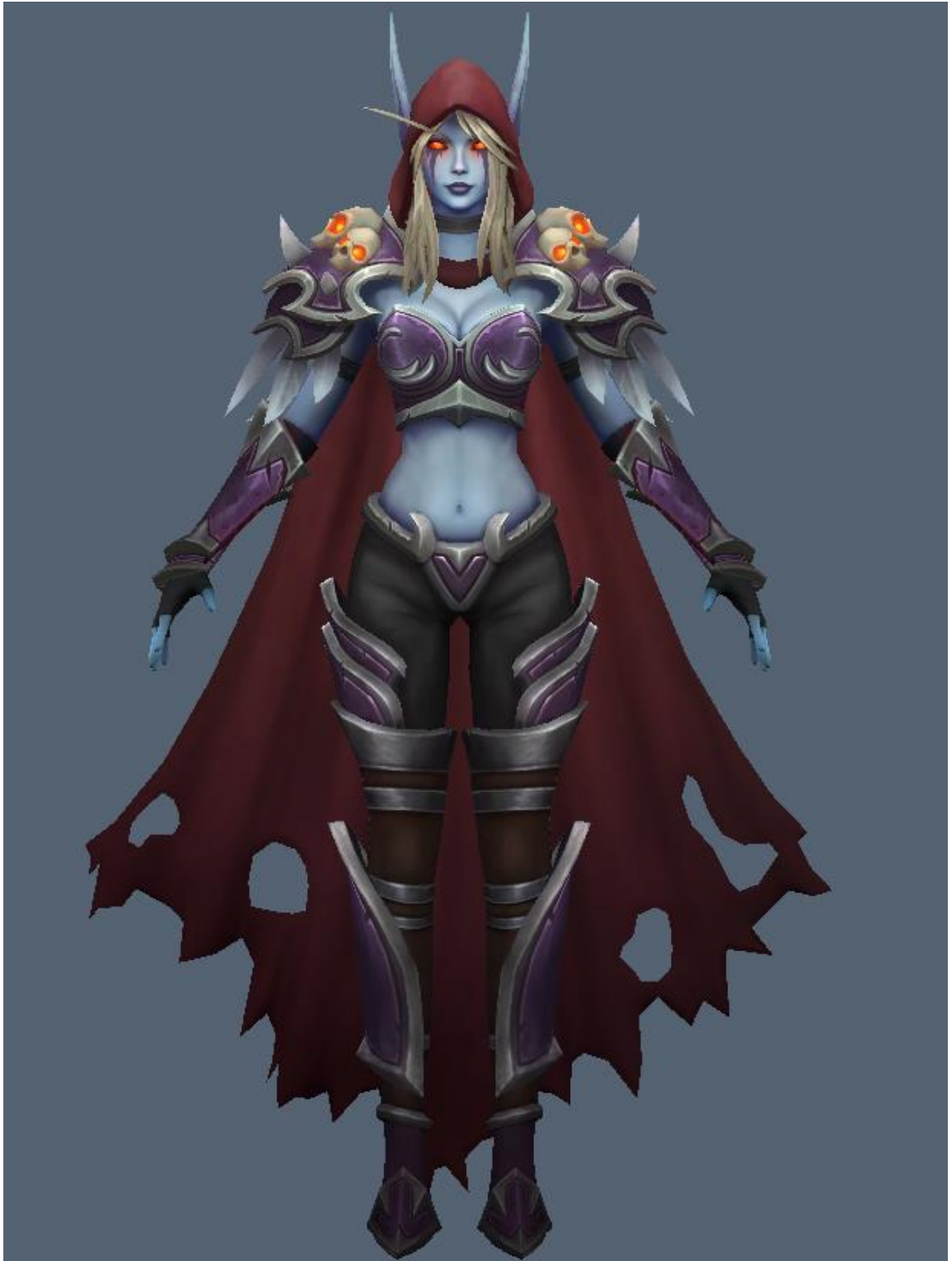


Figure 26. Sylvanas texture completed.

6 Project Analysis

6.1 Process and Results Analysis

To analyze the process of making Sylvanas, each step in the creation process went in accordance to the plan as well as the current generation game asset creation pipeline. The result is a 5,500 polygons character with 2k diffuse texture – the same amount of polygons that is found in AAA games with low-poly game characters. The texture size is also identical to the texture sizes used in the current leading games that use low-poly models and hand-painted textures.

Something that could be improved is the 3D model itself. Some of the armor parts/rims are not as clean and geometrical as they could be. Also Sylvanas's face from side profile could be more proportional. Something looks slightly wrong with her side profile and next time I would look into it more. This however has to do with my limited modeling skills as someone who is still learning and improvement comes with practice. Also her cloak has openings in it as signs of wear and tear. It is implemented geometrically, meaning there are actual holes. The next time it would be better to not make holes in the modeling stage but rather do "fake" holes by using transparency in the texture map.

Overall based on my personal analysis and feedback I have received, the results are great. It is important to take everything possible as learning experience from this project and move onto another that will be even better. Artists often get attached to their work which only slows them down. Results analysis and feedback are essential for grasping the drawbacks and weak points of the work but it is best to quickly move onto another project and continue practicing.

6.2 Professional Critique

To support the result analysis, the critique I received from the industry professionals is listed below. The factors that the table is based on are readability, technical optimization, and aesthetics, concluded with overall rating. Based on 1-10 rating, 1 is the weakest and 10 is the strongest.

Readability in this case means how well the viewer can read the character – its demeanor, personality and also visual readability and recognition of the character’s aspects.

Technical optimization means how well the technical aspects were carried out, for example polygon count, UV map optimization and texture size or how well the topology flows considering animation needs.

Aesthetics are rated based on how appealing the character is to the viewer’s eye and also how well it follows color, value and patterning theories.

Table 1 shows ratings from the artists that provided their feedback.

Table 1. Critique from professional artists.

Artist	Readability	Technical Optimization	Aesthetics	Overall Rating
Bruno Malta	9/10	9/10	10/10	9/10
Martin Vlas	10/10	-	8/10	9/10
Rodrigo Ramos	9/10	9/10	8/10	9/10

I wanted to receive feedback from artists with various backgrounds, to provide insight from different perspectives and better rate the visual credibility of my version of Sylvanas 3D character. Bruno Malta is a 3D artist at Electronic Arts. Martin Vlas is a designer at Ediso, and Rodrigo Ramos is a freelance illustrator and a concept artist.

7 The Future of Hand-painted Texturing & Conclusion

In the game industry the trends are always changing just like in most other industries. This varies greatly from game to game, but a few general trends can be observed. The requirements that companies set for artists are more and more demanding. What was sufficient a few years ago is not considerable nowadays. Both models and textures have come a long way. 3D models are cleaner, with big chunky details, and this does not seem to be changing any time soon. Depending on a game style, stylization is one of the primary concerns.

Hand-painted textures are following the trend of looking cleaner, more readable and minimalistic. I observed two approaches. One of them is an approach where the textures are painted very simplistically and the artist paints with clean strokes and simple color scheme as shown in figure 27.

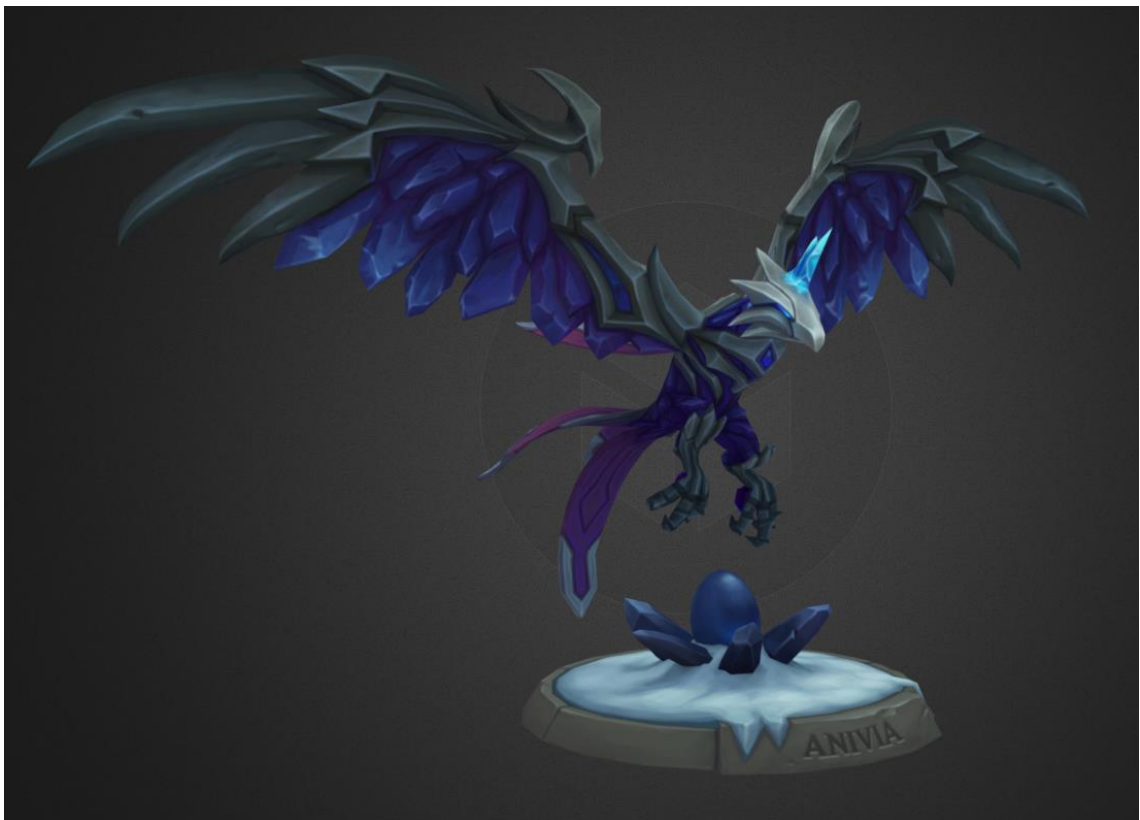


Figure 27. Simplistic style of hand-painted texturing [18].

In the figure the 3D model's texture looks very seamless but, observing and breaking down the texture, there are visible lines and supreme blending, and the colors look unified. Silver (grey), blue and purple are the main colors that can be seen on the character in figure 27. This does appear simplistic but to make it look appealing, much effort is put into the texture work. The blue seen in the figure is not just blue, as it has many shades of blue and purple, so the fact that the result looks minimalistic does not mean there was less amount of work.

Another direction which is developing for hand-painted style is the very painterly approach, inspired by classic artists such as Jeffrey Watts or John Singer Sargent. It is shown in figure 28.



Figure 28. Painterly style of hand-painted texturing [19].

In this style, this 3D weapon is textured in a very painterly hand-painted approach. There are many color variations that bleed into one another and the colors are less blended. The colors are blended as whole, in sections. Many shades of purple are sectioned off but blend together in a gradient.

It is difficult to categorize this style because firstly it is categorized by the respective game from which the style is determined. However producing clean, well readable assets that clearly have a lot of effort put into them is the link between all games with this texturing style nowadays.

This thesis is meant to summarize the entire process of creating a 3D character in hand-painted texturing style. The result of the project is a finished character as intended. All the information mentioned in this guide is supposed to help people interested in studying the style of texturing used by major game studios, for iconic games like World of Warcraft. It is rare to find a document that compiles the whole step by step process to help artists get started. The usual case for artists interested in this field is plenty of guess work and searching for professionals who are willing to reveal a secret or spare a few minutes of their time to explain a few things. This document removes the need for that.

All the necessary information to get started is presented in this document, but I highly recommend to anyone who is serious about learning this style to check out video tutorials by Kelvin Tan – 3D Artist at Blizzard Entertainment – and get in touch with any professional possible.

Sylvanas as part of this project turned out quite decent for the amount of time spent on it. It follows all the essential principles of texturing and that is what matters. There is definitely space for improvement but an artist has to know when to stop working on their model because in real working life there are limitations and tight deadlines. If this project was done all over again, Sylvanas would definitely turn out even better, because it would have been done a second time and practice has proven to be the single most important factor leading to improvement.

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