DESIGNING THE WORLD OF 3D CG ANIMATION "BALLOON" THROUGH LOW POLY VISUAL STYLE

Christian Aditya

Abstract: This research focus on the process of creating the world of "Balloon" through low poly visual style in 3D CG animation using an alternative non-photorealistic rendering method that is both efficient and visually astonishing. Low poly are chosen as a visual style because it represent the spirit of courage to explore the world outside the film's story. By using low poly visual style in most of the environment, it creates a unique contrast between the environment and the character. The character is made using a traditional high poly modeling for 3D character. Through variety of experiments with various pipeline, the chosen method is considered the best to accommodate the filmmaker needs in both production time and the visual result. In order to determine the best technique, the research is conducted by testing the render results of some environment scenes within the film. The writer also experimented using procedural materials in the design of the world to help speed up rendering of the compositing process, in order to achieve good visual quality in a shorter production time.

Keywords : low poly, non-photorealistic rendering, 3D CG animation

Introduction

As CG technology continues to advance, 3D or CGI movie industry also developing quite fast in the recent years. Furthermore, we can see tremendous amount of CG animation products with variety of forms in the market right now.

Majority of movies we found in the market right now, heavily relies on 3D Animation / CG technology. To that end, this CG technologies can be really helpful to visualize a story to the audience. Having said that, this trends conduce a boring trend, in spite of watching a film with great story, Audiences are bombarded with visuals that are exceptionally similar in every movies.

Computer graphic products tends to be moving forward to realism, both in the film industry and academic research regarding computer graphics. That is to say the goal has been achieved even though for some areas like facial expression, we can still see some minor problems ("Yen-Jung Chang – Strategies for a Reduction to 2D Graphical Styles in 3D Computer Graphics with Hybrid Aesthetics | Animation Studies Online Journal", 2017).

Christian Aditya adalah pengajar tetap pada Program Studi Televisi dan Film, Universitas Multimedia Nusantara.

e-mail: christian@umn.ac.id

By looking at these phenomenon, this research offers an alternative way to utilize 3D animation technology, as a tool to convey a story to the audience. Hence, low poly visual style that are generated through non-photorealistic rendering method is chosen to represents this idea.

"Balloon" is an animation that explores the ideas of courage, freedom, and the decision to go against the status quo. The main character in the story is faced with a choice to venture out if his comfort zone and explore the world beyond.

Low poly visual style is considered as the right kind of visual style for this animation as it shows a lot of different environment design that showcases the uniqueness of this particular style.

Research Background

In the world of digital art, photo realistic result has been the long-time goal of every artist. An artist can only achieve such result as long as it is supported by the technology that are available today. The appearances of Low poly art in the recent years gives a "fresh wind" in the crowded world of digital art said T. Schneider (2014).

Low poly art as a new art form were born from the point where digital artist accepts and embrace the flaw of low polygon object as its superiority.

In Indonesia, where the writer lives and work, local animation products that are widely produced, even though still containing local story, the visual style to present the story is still too generic and heading to a mainstream visual style.

By conducting this research, the writer comes up with a technique of producing a 3d Animation with low poly visual style utilizing a non-photorealistic rendering method.

With this in mind, the method found by experimenting with different kinds of production pipeline can greatly reduce the amount of production time significantly with a unique visual result.

In this Particular research, the writer mainly uses Autodesk 3DsMax software, utilizing its procedural material that included in the default settings of the software.

3D Animation

3D Animation is a product of 3D Computer graphics, this is a term used to describe every products resulted from its every production line. 3D Animation itself has a lot of output, in every industry utilizing 3D animation software has different approach in producing and in the final product. 3D animation has many different use such as: film, television, video games, advertising, science, architecture, and product visualization according to Beane (2012).

Low-Poly Modeling

Low –poly represents the mesh object produced by modeling process with low poly count. Low-poly mesh usually are used in applications with real-time rendering process. This allows the real-time rendering engine to work faster. Low-poly model has a noticeable contrast compared to high poly model which are usually used in films.

It is a common knowledge that to achieve a realistic result of a 3d object

in their 3d render, artist needs to apply more polygons in their 3d object. The fewer the polygon, it is much harder to show the realness of that object and it will become some kind of digital construction with the noticeable differences in looks that shows individual geometric units in a 3d object.

Low-Poly Art

From an online article "What's the Deal with Low Poly Art?", Sessions.edu, (2016) states that Low poly art arise on the beginnings of 3D Animation development. By using low poly model can greatly reduce the rendering process of film or application.

Even though the technology of CG (Computer Graphic) greatly flourish the entertainment industry, the usage of low poly model. CG artists use simple polygon in their composition to communicate ideas using textures and depth,
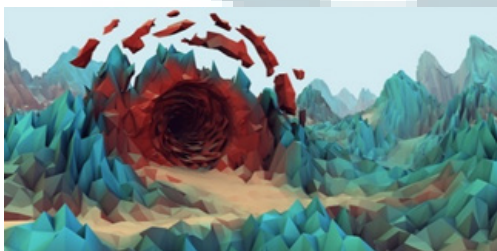

Fig 1. Low-poly Art by Calder Moore. Retrieved from: https://www.sessions. edu/wp-content/uploads/low-poly-calder-moore.jpg

without having to sacrifice minimalist aesthetics.

Non-Photorealistic Rendering

Non-photorealistic rendering (NPR), is a rendering technique that uses the al-

gorithms of computer graphics with the output of stylized graphical images that do not resemble the result of real life photography (Strothotte & Schlechtweg, 2002). The NPR style is used on this film to emulate the looks of low poly visual style.

"Balloon" Animation

This research is based on the needs to create a visual style for the writer's 3d animation project. "Balloon" tells a story about a journey of a character (In this case a creature) that explores the world outside of his origins island. The adventure begins when the main character found a mentor whose a bit weird look-
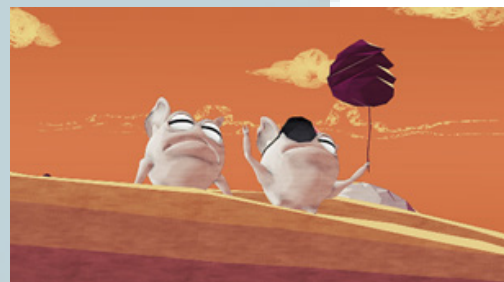

Fig 2. Excerpt from "Balloon"

ing because of many accessories, stuffs and odd behavior due to his experiences on journey outside of the world.

Unfortunately, the other creatures that lives on the island couldn't accept any weird or strange way of life that are different from theirs. Different from other creatures, the main character seems interested in his mentor's way of life, so he wishes to learn more. In the process The Mentor gives him a weird looking flower that can turn into balloon and carries him to the air. Therefore the adventure begins when the main character fly with the balloon and explore the world outside.

The World Inside "Balloon"

The world in the animation plays a really important role in this animation, as most of the scenes shows the main character floating with his balloon with a long shot of the environment in the background. Creating an amazing looking environment is a must, to convey the spirit of "adventure" in the animation.

In this animation there are total of 7 different environment design, with different color and light schemes.

In this research, the writer will only focus on 2 scenes with 2 different environment designs that can represent the variety of looks in the animation.
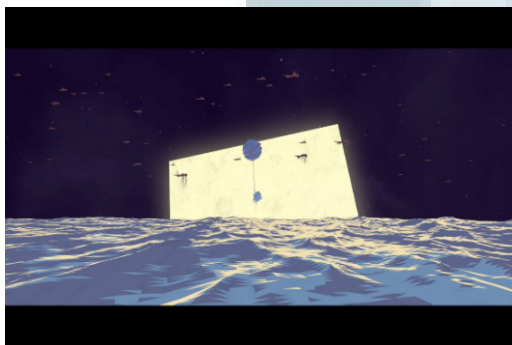
Environment Visual Concepts

Fig 3. Ocean Scene Screenshot

In this research there are 2 chosen environments to represent the application of the visual style. The first one is the ocean environment (Figure 3) that are shown in the opening of the animation as it represents the application of this technique on an exterior scene. Second is the cave environment (Figure 4) that represent the interior scene.
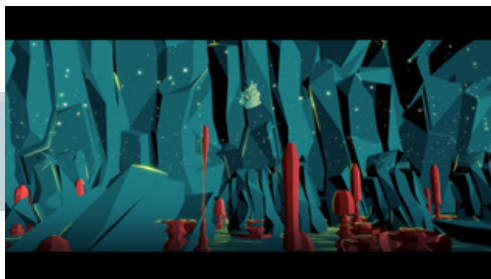

Fig 4. Cave Scene Screenshot

Ocean Scene Visual Concepts

The ocean scene sets at night. Following the theory of environment lighting from Jeremy Birn (2006) in the book "Digital Lighting and rendering". Night scene's lighting conditions are affected mostly by the moonlight as the key light source. The writer has to be aware to add highlight on the surface of the ocean and to make the overall looks of the night scene visually appealing.

This night scene uses soft blue color for the skylight and yellow color for the moonlight, creating a crisp yellow highlight on the surface of the ocean water. The ocean water itself has blue and purple color which are beautifully in contrast with the moon highlight. On the moon surface the writer adds soft glow to achieve dramatic looks.

The main character that floats in the air, has blue purple color following the atmosphere color of the sky. We couldn't see noticeable highlight as his position is directly in front of the square moon, which cast the yellow highlight.

Cave Scene Visual Concepts

The cave scene sets at day, however, because of the interior of the cave it creates a certain feeling of darkness with a hint of light from the bounce light cre-

ated from the sunlight. The sunlight cast over the edge of the cave opening, so the sunlight bleeds from the end of the cave to the inside. As we can see most of the cave interior has black and blue color with a hint of yellow highlight.

Another visual key of this scene is the mushroom like creature. Red color is chosen because it creates a nice balance and contrast with the blue and greenish overall atmosphere of the scene. The main character's color follows the major color of the atmosphere which are blue green, with yellow rim light from the sunlight.

To create a certain feeling of light emerges from the outside of the cave to the inside. Ray effects are given to emphasize the sunlight. To further enhance the feeling of light coming to the inside, small light particles are given inside the cave.

Applications of Technique to Achieve Low Poly Visual Style

On producing this animation, the writer uses Autodesk 3Ds Max as the main software. To create a certain style of NPR, the writer experiments with various techniques of rendering, with both direct illumination technique and indirect illumination technique before finally decide to use direct illumination rendering technique harnessing the power of the procedural material available in the software.

To simplify the explanation of the process in creating Low poly visual style, this is a chart that represent the writer's pipeline (Figure 5).

Creating Low Poly Model

We can't achieve low poly looks with-

Low poly modeling (with enhancement)

↓

Color and Material

↓

Render and compositing
- Base color pass
- Ambient Occlusion
- Highlight pass
- Effects and color adjustment

Fig 5. Pipeline Chart"

out modifying the 3d objects to a certain shape and form. In this particular project, in order to achieve the desired look, the writer simply creates a 3d modeling with a minimum poly count but still paying attention to the initial silhouette of the 3d form.

The 3d modeling process of the assets are not significantly different from any other 3d modeling process. Having said that, initial modification is needed to bring out the uniqueness of low poly.

The first step of the process is to model a 3d object that represent the asset that we desired. In order to simplify the process The writer will show the process of modifying the object with a simple teapot model available inside the software with 256 poly counts (Figure 6).

Secondly after finished with the initial shape and form, what to do next is to change the diminish all of the smoothing groups of the mesh. We can see a noticeable difference on the way the surface looks on the 3d object after this simple
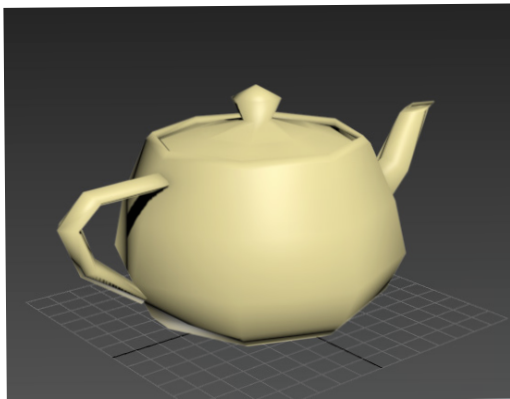
Fig 6. Default teapot model without enhancement

process (Figure 6).

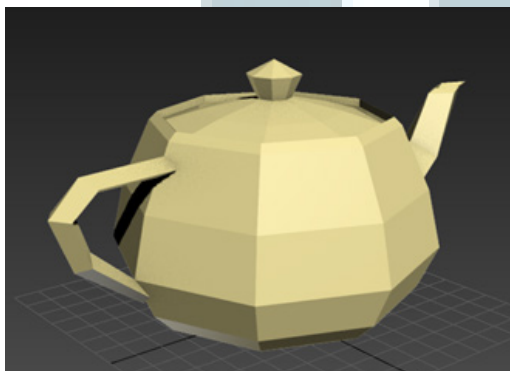After these steps, we can further modify the low poly looks by adding more

Fig 7. Default teapot model without enhancement

modifier to the 3d model according to the our needs. In this case, modifier that can be use are modifier that helps maximize the broken look of the poly like "tesselate", "lattice", "noise", etc.

Color and Material

To achieve an NPR look in an efficient way, procedural map are used on this project. Procedural map has several

advantages over bitmap, one of them are the ease of use and the flexibility to decide what color are going to be on the surface of the object.

"Falloff" is one of powerful material that are available in 3Ds Max. Falloff map generates values from white to black, based on the angular falloff of the face normals on the surface geometry. The direction used to specify the falloff varies, depends on the methods that we choose. We can also change the color from black and white, to any color that we desires.

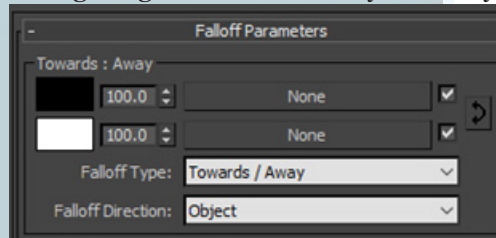With this in mind, to emulate the real life lighting condition in a stylized way.

Fig 8. Falloff map parameters

The writer changes the falloff type to "towards / away" and also change the falloff direction to "Object". This allows the writer to emulate a real life lighting situation, by choosing 1 dummy object as a "fake" light source. This decision results in a notable advantage, where instead of having to set lights all over the scene, the writer only need to put 1 dummy object and the rest of the color on the map will follows the direction of the dummy.

As we can see, the dummy object (highlighted with red arrows) (Figure 9) placed outside of the cave will result in the color direction of the cave rocks and any other assets in the scene.

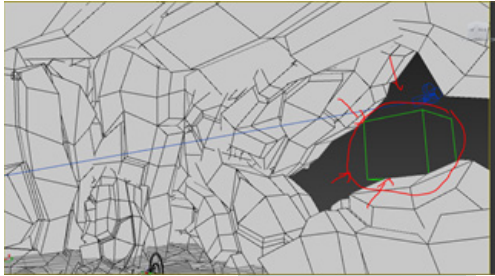This allows us to easily change the direction of the color on every poly sur-

Fig9. Cave scene with material and dummy

face. The writer choose 2 colors which are black and blue green, with certain amount of gradation steps. After done with all the setups, now the lightest color will be located and face towards the light source. On the other hand, the darkest color will be facing away from the light source, resulting in a "fake" lighting condition that are based of real life lighting (Figure 9).

As we can see on figure 10, Black

Fig. 10 Render result

color are positioned away from the light source, and the light blue green are facing towards the light source, which is on the outside of the cave. This process are similar in every other scenes, with the differences on the choice of color gradation.

Render and Compositing

After setting up the initial color of every objects in the scene, the process of

rendering is actually pretty simple. The writer uses default scanline renderer inside 3Ds Max which is fast and easy to setup.

The "falloff" map are used inside of diffuse color in standard material of scanline render engine. Because there are no light being used, color illumination of the material has to be set on 100% so there are no shading happens because of the material attribute, as it fully shows the true color of the material.

With this in mind, all of the color of the object that we can see on the screen is fully determined by the writer choice of color. Hence resulted in the base color render pass (Figure 10).

To achieve the final looks that are shown on the screen, several passes have to be rendered and added to the base color render pass.

Ambient Occlusion

To further maximize the feeling of low poly within the 3d object, we need a soft shadow that can enhances the seams on every polygon surfaces. Ambient occlusion helps to further suggest the "broken look" of low-poly visual style. That said, the writer still need the use of mental ray render engine, which offers ambient occlusion material on its material library.

Ambient Occlusion creates a soft shadow that lingers on the edges of 3d objects, and also on the edges which are created from the overlapping of more than one 3d objects on the scene (Figure 11).
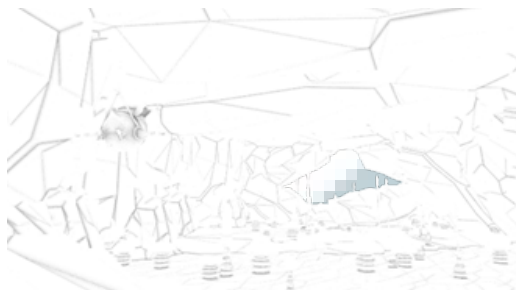
Fig 11. Ambient Occlusion pass

Highlight Pass

Secondly, the highlight pass, this particular render uses the same technique as the base color pass, the differences are instead of color, black and white are chosen as the color in the falloff map, resulted in black and white render with white area determining the highlight area.

After the render finished, in the compositing step, the highlight pass used as the base to mask the desired highlight color (Figure 12).

Fig 12. Highlight pass

Depth Pass

This render pass is to create the illusion of depth (Figure 13), through atmospheric fog which are achieved in compositing step. This so called depth pass are usually can be automatically produced using Z-depth pass in multi-pass rendering option in any render engine. In this particular project, The writer maximize

the potential of "falloff" material in 3Ds Max, by changing the falloff type, we can achieve a similar result with significantly faster render time. Adjustment of the depth level can be easily done within the material settings.

Depth pass can be used as map source to camera blur in compositing process. In this case, depth map are used as a masking map to create a foggy effects on the animation.
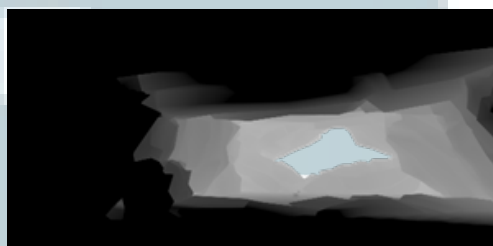

Fig 13. Depth pass

To enhance the visual quality even further, particles and effects are used to give a beautiful imagery on the screen.

In this scene, The writer puts small particles that fill up the whole cave interior.

Secondly glow and light ray effects are given to the final compositing result. This add some realness into the whole scene even though the final goal is to create a non-photorealistic result. After some color adjustment the final result
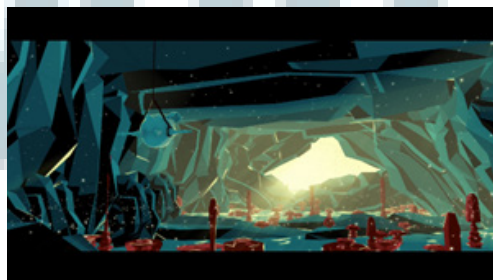

Fig 13. Depth pass

are made. It may looked complicated because there are many passes needed to create the final looks. However with a good file management and sequence naming, the process actually quite simple and easy.

Conclusions

In this research the writer talked through the process on coming up with a technique to create a stylized 3D CG animation with a unique visual style which is Low-poly. This technique and process are considered effective, since the production of this whole animation "Balloon" only produced by the writer himself.

The technique to create the visual style of this animation can be applied to any other 3D CG animation project. As it truly maximizes the potential of procedural material available in 3d software, without any other plugins / 3rd party render engine, A beautiful image result can still be made.

The technique can be easily integrated into production pipeline of a small studio or even students with limited budget and limited production time. This technique heavily relies on the ability of the filmmaker to integrate his knowledge of art and design, because every single thing that appears on the screen are resulted from ideation and decision of the maker (without too much depending on computer specs and such).

This doesn't mean that this technique is perfect or without any flaws. However because of the simplicity of the process, we can minimize many technical problems which can be found in any mainstream 3D CG animation production process.

References

Beane, A. (2012). 3D Animation Essentials. Hoboken: John Wiley & Sons.J. Birn, [Digital] lighting and rendering. Berkeley, CA.: New Riders, 2006.

Birn, J. (2006). Digital Lighting & Rendering, Second Edition. New Riders.

Schneider, T. (2017). A comprehensive history of low-poly art, Pt. 1 - Kill Screen. Kill Screen. Retrieved 4 August 2017, from https://killscreen.com/articles/poly-generational/.

Shaffer, H. (2017). Low Poly Art - Notes on Design. Sessions College. Retrieved 4 August 2017, from https://www.sessions.edu/notes-on-design/whats-the-deal-with-low-poly-art/.

Strothotte, T., & Schlechtweg, S. (2002). Non-photorealistic computer graphics. San Francisco, Calif.: Morgan Kaufmann.

Yen-Jung Chang – Strategies for a Reduction to 2D Graphical Styles in 3D Computer Graphics with Hybrid Aesthetics | Animation Studies Online Journal. (2017). Journal.animationstudies.org. Retrieved 4 August 2017, from https://journal.animationstudies.org/yen-jung-chang-strategies-for-a-reduction-to-2d-graphical-styles-in-3d-computer-graphics-with-hybrid-aesthetics/.