Animation Pipeline Disruption: Study Case of Usage of Game Engine in Animation Student Project

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Abstract
Technological developments lately have disrupted many things. One of the disruptions was the production of 3D animated short films. Beane (2012) has described production pipelines for 3D animation production. A lecturer and CG (Computer Graphic) artist in animation, we are used to hearing about the 9 phases in 3D production: research and development, modeling, rigging, layout, animation, VFX, lighting, and rendering. However, since 2015, a lot of game engine software has sprung up, making the animation process much easier and more independent for 3D Artists to create works, such as Unity, Unreal Engine, Cry Engine, and others. Based on this phenomenon, the author sees how agile students learn these processes and quickly adapt them to create their animation films. Therefore, the researcher will conduct a case study on three short films that use a game engine in their production pipeline and how it affects the conventional 3D production pipeline. The research aims to discover its influence and relevance to the traditional 3D pipeline.

Keywords: Animation Pipeline, Game Engine, Short Animation

Introduction

Initially, animation originated as a method of filmmaking that utilized the principle of persistence of vision, where moving images were created based on several still images arranged sequentially. (Max Hartmann, 2015). This research proved that to create a consistent image, humans have a frequency of 24 Hz in 1 second. This term is known as 24 frames per second. Based on this principle, forms of animation began to develop. One of the significant developments is digital technology. This means that animation production nowadays does not only use paper as a medium but also with computers and digital. In 2016, Unity Engine released Project Adam. (Efremov, 2023) This project was one of the most significant animation breakthroughs in 2016; in making it, the production team used a game engine - software used to create games and applications - to produce the visuals for the film. This can be done because of a feature called real-time rendering, which conventional 3D production software does not have.

Since then, the popularity of game engines for creating various forms of entertainment has become increasingly widespread. Apart from games and animation, the benefits of game engines have also penetrated the film industry. Currently, two large commercial game engines are often used in film and animation making: Unity and Unreal Engine. (program-ace.com, 2022). These two game engines even released features used for animators and filmmakers by creating the taglines Unity: 3D Animation Software for Film & Television and Unreal Engine: Film & Television. According to data released by Grand View Research, the market valuation of these two game engines is getting bigger and bigger. The market valuation for game engines in 2023 will be 2,688.8 billion dollars and will increase until 2030 with a prediction of reaching 8,261.6 billion dollars. Annual market growth will increase by around 17%. Indirectly, this figure shows that the use of game engines is increasing (Grand View Research, 2022).

From a production perspective, using game engines in production offers many benefits. The first benefit is that it is easy to get excellent visual results. The second advantage is that a real-time rendering feature makes the rendering process much shorter (cgicoffee.com, 2020). Cutting production time will have an impact on many things. One of them is fewer working days and more efficient use of electricity. The third advantage is that, until now, the two game engines have not been paid for up to a specific production level. Game engines can be freely downloaded and used by companies or individuals. This is understandable because, on the other hand, game engine companies also need data from users about the usability of their products. These benefits have also contributed to the industry's increasing popularity of game engines.

The use of game engines has also spread to students. Many students are starting to explore using game engines for various personal projects. Seeing this phenomenon, in this research, the author wants to find out about two important things; the first is that the author wants to find out about the utilization of game engines for various independent projects from students. Second, the author seeks to confirm whether the 3D animation creation pipeline is still relevant today. In this research process, the researcher did not intervene regarding when and how game engines should be used for animation production. The students who were observed learned to use game engines from various sources available on the internet, as well as mentoring from peers. The author hopes that with this research, the author can find patterns of using game engines for animation production that can be applied in classroom learning in the future.

Research Method

In this research, the Researcher uses mixed methods, namely a collective case study followed by observation as a research method. The author will conduct a case study of 3 student works that use game engines. The game engine chosen by the four teams was Unreal Engine, released by Epic Games. Then, researchers will make observations for each group regarding the use of game engines. Each student has the freedom to determine their pipeline.

In this research, the author will observe how students adapt to the 3D production pipeline when using game engines as one of their productions. The animation production pipeline comprises 9 phases: Research and Development, modeling, texturing, rigging, layout, animation, Visual Effects, lighting, and rendering (Beane, 2012). This production pipeline is widely used by students and independents in making 3D animated films. Each phase has a crucial role in the creation of 3D animated films. In his book, Beane explains the processes that occur in the nine phases. Each phase has its schedule and difficulties. The following is a production workflow by Andy Beane.

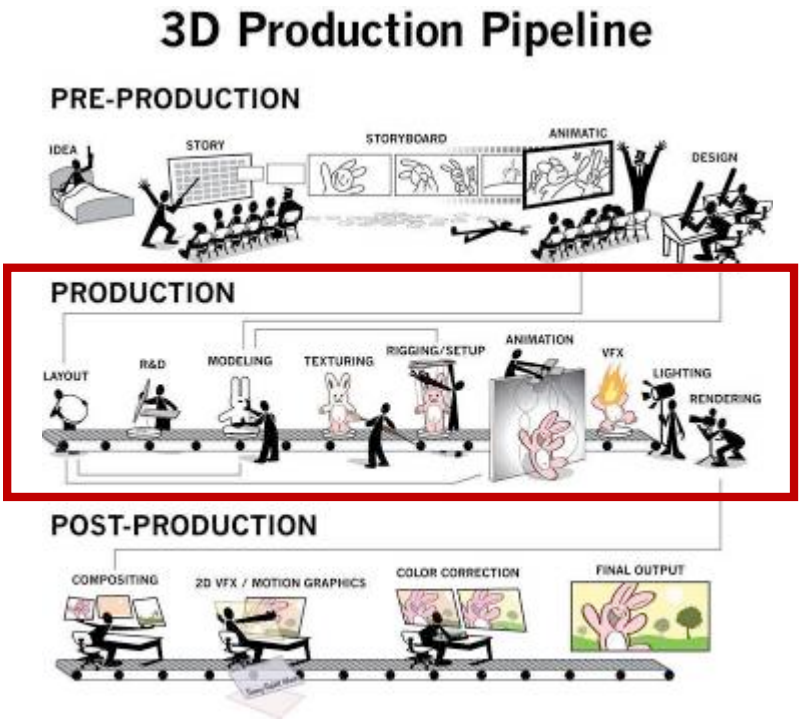

Figure 1: 3D Animation Production Pipeline by Andy Beane

In practice, several software is used to produce 3D animated films. For example, for 3D modeling work, there is Autodesk Maya, Zbrush, or Blender. Texture or digital painting work can also be done in Adobe Illustrator, Photoshop, or Substance software. However, when entering the rigging phase, the production workflow is generally reduced to just one software, such as Autodesk Maya or Blender, until it finishes the lighting and rendering phase.

The Cases

The following are the three films used as data sources for the research.

1. Furwell

Furwell tells the story of a person who misses his deceased pet. Amid his longing, the person felt the spirit of his pet inviting him to play one last time. In the end, this incident brought peace to the person. (P.Y., 2023) Aylen Archangela P. Y directed this film.

Figure 2: Title Screen Furwell

Furwell was created in 2023, starting from January to July. The technique used is a 3D animation technique with a non-photorealistic visual concept. This film, which is around 5 minutes long, emphasizes visuals like a painting with lots of soft shading and textures like brush strokes. In making this film, the production pipeline changed to the conventional 3D animation production workflow. The following is the treatment that occurred in the making of this film:

1. In this project, there are only eight work phases. This project has no VFX phase, as no VFX was done for the 3D level: research and development - modeling – texturing – rigging – layout – animation – lighting – rendering. For this team, the absence of VFX made this production much more straightforward. Visual effects, such as smoke and increasingly transparent pets, were carried out in the post-production phase using After Effects.
2. In this project, The Research and development phase oversees the entire production from the beginning of modeling to the end of rendering. This aims to function as a Research and Development technical supervisor for the move from Autodesk Maya to Unreal Engine.
3. Non-photorealistic visual style does not cause problems in production. This is because the texture provided has been prepared to be a non-photorealistic result during the texturing process, such as color selection and soft shading given to the environment.
4. In this creation, Unreal Engine is the game engine software. Unreal Engine contributed to the lighting and rendering stages. Other production parts are done with Maya software.

Figure 3: Screenshot from Furwell's cut scene

The use of Unreal Engine is in the lighting phase and rendering phase. In this process, it can be seen that the use of game engines is beneficial in the final production phase. This team uses a game engine to help the lighting and rendering process faster because they do not have much time. For more details, we can see the production flow of the Furwell Animation 3D film in the chart below.

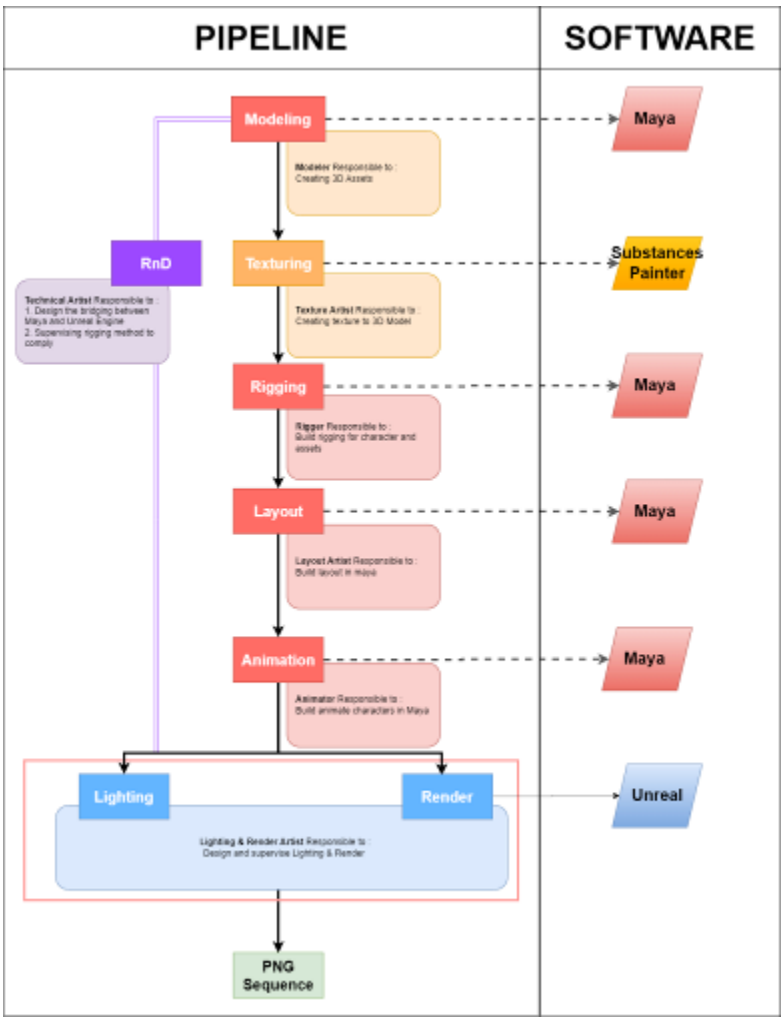

Figure 4: Furwell Production Pipeline

2. Swalty

Swalty is a story about the conflict between kitchen spices, namely Sugar and Salt, regarding who humans like most. In the end, they both realized that despite their differences in characteristics, in the end, they could not help but reconcile the situation and could produce good food. (Ritchie, 2023) This 3D Animation film, which is 4 minutes and 58 seconds long, was directed by Nyimas Fathiah Ritchie. This film was made to participate in the XVI Gemastik Competition. This national-scale (Indonesia) competition targets students in technology and informatics. In this competition, the student team was successfully selected to become finalists.

Figure 5: Title Screen Swalty

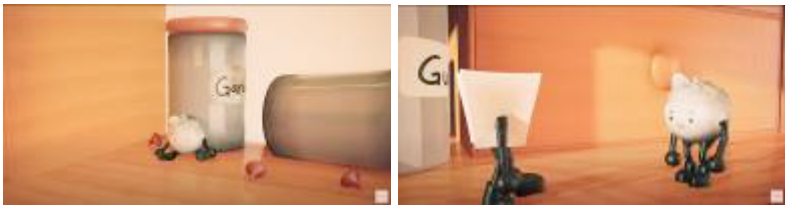
Figure 6: Screenshot from Swalty cut scene

The duration of making this film was concise, namely, two months of work from pre-production to the post-production process. The production team performed several production adjustment processes to get around the minimal time. The following are the steps taken:

1. The Production Team uses motion capture to assist the animation process. At the start of production, the assumption was that motion capture was expected to reduce animation time, which took quite a long time.
2. The Production Team uses a game engine in film production. The team will utilize the real-time rendering feature of Unreal Engine.
3. The software used in Swalty production is Autodesk Maya for modeling and rigging. The production team uses Substance Painter to create texture assets at the texturing stage. The team used Axis, motion capture software, and reprocessed in Maya at the animation stage. Layout, lighting, and rendering stages using Unreal.
4. Adjusting the sequence of production phases between the layout phase and the animation phase. In this Swealty production, the Production Team first carried out the animation process and then the layout phase. The animator focuses on capturing movements according to what has been depicted in the storyboard using motion capture, while the modeler and layout artist prepare the set to be immediately ready for use in Unreal Engine. When the animator successfully imports movements from motion capture into 3D characters, the results are immediately given to the layout artist for layout directly in Unreal Engine.

The following is a chart showing the production flow carried out.

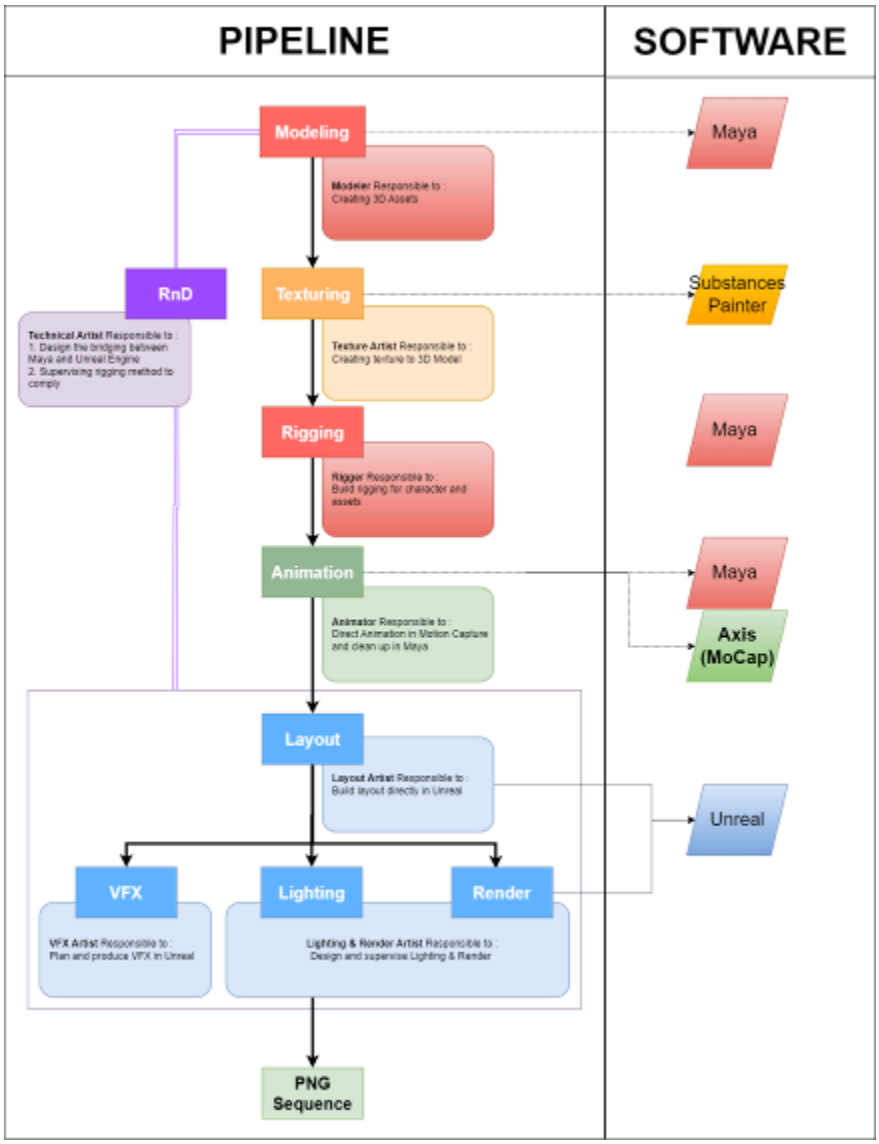

Figure 7: Swalty Production Pipeline

3. Cybercock

Cybercock tells the story of the struggle of a fighting chicken from a village against a fighting chicken that has been well-trained. This cockfighting takes place in the future, where technology has been used to help improve the performance of fighting cocks. Darsan Marco Tanuardi directed this film. This film was released in 2020, 3 years before Swealty and Furwell (Tanuadi, 2020).

Figure 8: Cinematic Render Cybercock

The production team used the Unreal Engine game engine in the final stage to make this film. The production team chose Unreal Engine because it was hoped that Unreal Engine could cut the film production time. In the initial plans for this film, the film was planned to be around 10 minutes. The production team also used Unreal to create the visual effects in this film. The total time required to produce this short film is around six months.

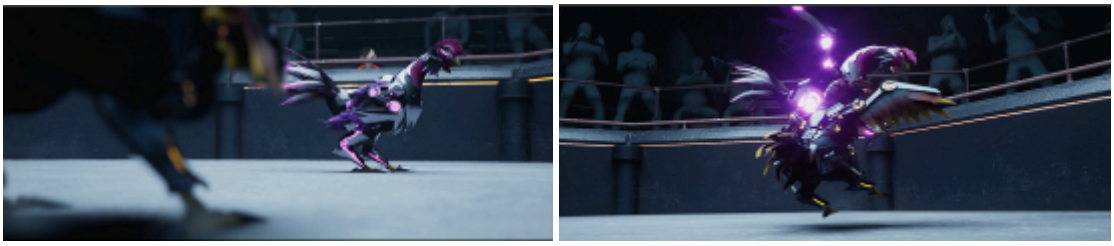
Figure 9: Screenshot from Cybercock cut scene

In general, the workflow used in making this film is similar to the two films above, Sewalty and Furwell. The software used is Autodesk Maya, starting from modeling to the animation phase. In making this film, the Production Team also used Unreal Engine to create the visual effects in the film. Examples of visual effects are sparks, explosions, and smoke. The research and development division is vital in overseeing the production process. Modeling and rigging were tested repeatedly because many aspects were tested in this film, such as rigging for the chicken character, shaders for the lights on the chicken's body, and visual effects created by collisions between objects in Unreal Engine.

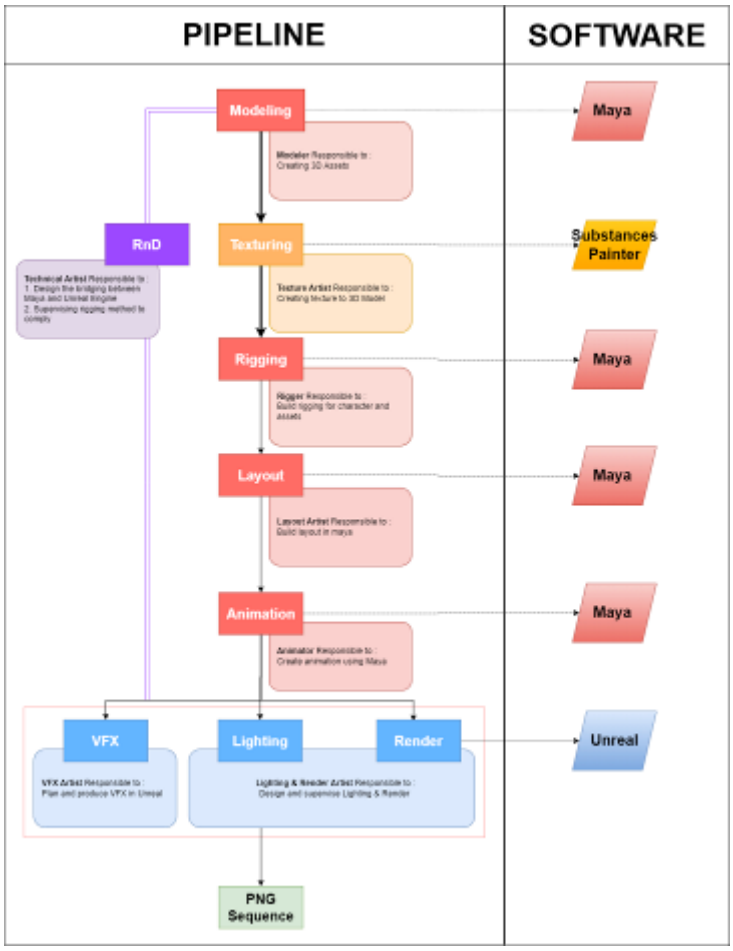

Figure 10: Cybercock Production Pipeline

Findings

Based on the observations of the three projects, the author obtained several findings that can be considered for development, especially in animation education. These findings are:

1. Unreal Engine does offer much faster production speeds in terms of rendering calculations because of the real-time rendering feature.
2. Using the rendering settings in Unreal Engine is quite simple. This can make it easier for students to produce good renderings. However, this convenience will have a negative impact if students do not fully understand the rendering process in depth.
3. Using game engines also allows animators to create production workflows according to what is needed on a project.
4. Game Engine also makes production much more efficient because the required tool (computer) resources are less than conventional rendering methods. The use of electricity is more efficient compared to conventional rendering.
5. One of the weaknesses of rendering using a game engine is that several errors are sometimes not predicted at the start of production. Besides that, the solution to this problem is not necessarily in the forum or documentation on the official website.

Conclusion

Based on observations made on three projects that use game engines, the author can conclude that game engine unitization is inevitable in the animation industry in the future. Based on the author's observations in this research, game engines have succeeded in disrupting the

animation industry. Many individuals, students, and professionals have tested game engines in independent projects. However, the presence of game engines in the animation industry has not been able to change the previously established 3D animation production flow. The impact will be felt in clustered 3D production phases (lighting, VFX, and rendering). The impact factor mainly includes efficiency and how each phase works. Until now, the presence of game engines cannot massively change the animation pipeline.

The advantage of the game engine is real-time rendering, which helps produce 3D animated films for individuals, especially students. The ease of access to the Unreal Engine has also led to the use of game engines in animation production. Even though it is not as stable as established 3D software like Maya, these two things attract people to continue exploring the various possibilities of game engines like Unreal Engine. This change will gradually have an impact on education. This phenomenon's biggest challenge and opportunity is how educational institutions can synchronize learning quickly. However, the potential for utilizing game engines in making 3D animated films has the opportunity to be a new wave in streamlining the animation pipeline in the future.

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