

Study the Differences and Similarities Between the Techniques of 3D Animation and Stop Motion Animation

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Received: 8 March 2022; Accepted: 12 April 2022; Published: 14 May 2022

Abstract:

With the rapid advancement of CG technology in the past few years, we have seen more and more three-dimensional animation combined with various art styles achieved great success in the animation industry. This trend is continuing to grow regarding its special aesthetic effect and creativity. We can read this blend by reviewing some up-to-date animation films, such as *Spider-man: Into the Spider-Verse*, *Love Death+Robot* and *Soul* etc. As for this project, the author will explore the potential of using Stop-motion animation techniques and study the methods that stop motion animators would normally utilize.

Keywords:

Stop-Motion Animation, 3D Animation, Animation

1. Introduction

There is a long history of Stop motion animation since it has been viewed as an independent animation form. It is more experimental and organic in the making process. It is notable for taking authentic materials, animation methods, camera settings, and lighting. Compared to Stop-motion animation, 3D animation is the method to produce characters and props with computers. The 3D animators can easily make nice and smooth animation by utilizing 3D software. They can also add as many details in the production to make the animation more believable. But once this kind of 3D animation method becomes a stereotype, it could make the audience feel uninterested and uninspired. Similarly, the animators who work with 3D assets may feel unsatisfied with the materials since they can never touch them in reality. Therefore, creating something visually new or different animation is crucial for all the artists in the 3D animation industry. Therefore, this research paper will mainly focus on analyzing the differences and similarities between the techniques of 3D animation and Stop-motion animation.

2. Materials and Methods

This article reviews the literature on 3D animation techniques and stop-motion techniques. Data from observation typical 3D animation and stop-motion animation and contrast experiments are analyzed, applying qualitative content analysis. Literature studies are carried out by collecting articles on stop motion animation journals, books, and articles found online. Observation studies will investigate stop motion animation and behind the scene videos in terms of the techniques and workflows. After obtaining these data, the author will apply the methods found from the data and conduct experiments by testing the stop-motion animation style movements and textures in Maya and evaluate the results.

Our goal for this research is to explore if we can combine stop-motion animation techniques into Maya animation to inspire creativity and vitality in the 3D animation industry. This research will be significant for the artists who want to take different solutions with their 3D animation works.

3. Stop-MOTION Animation and 3D Generated Animation

3.1. Stop Motion Animation Background

The stop motion animation technique originates from early film exploration. During the silent film era, many filmmakers started to invent and study the methods for film making. Georges Melies made a great contribution to developing the film techniques including editing, multiple exposures and substitution photography etc. The new camera technique allows George to adjust or change the subject with the camera stopped when shooting a shot and reconnect the finished shots to the previous sequences (Gasek) [1]. It turned out to be the prototype of stop-motion. In 1898, Albert E Smith and James Stuart Blackton made *Humpty Dumpty Circus* (Figure 1), which was an early example of stop-motion. This short animation utilized children's wooden toys to mimic the action of circus acrobats (Priebe 9) [2]. Since then, stop-motion had reached a new plateau in the 20th Century. Harryhausen became a brilliant Stop motion leader who created a technique called Dynamation which allows stop motion animation and live-action to integrate (Maselli 56) [3]. In the film *Jason and the Argonauts*, Dynamation had been utilized as visual effects to give lives to the skeleton soldiers. Around the same period, the England Aardman animation studio created *Wallace and Gromit* by using the same method. The studio built its own stop motion animation style and had a remarkable achievement around the world. As a result, stop motion animation as an art form began to blossom and gained more popularity with audiences and artists.



Figure 1. The Humpty Dumpty Circus 1908.

3.2. 3D Animation Background

The development of 3D animation owed to computer technology. For a long time, many people regarded the computer as a calculating machine until in 1960, some inventions opened new paths for the computer to move into arts and creation area. Willian Fetter is one of the creators who bring the term computer graphics. His work *Boeing* utilized computer to produce 3D models of objects and the human body, which made him the father of 3D animation (Oppenheimer) [4]. When the time goes to 1971, the first 3D animation studios Triple-I were established. Lucas film founded graphics group department which had become Pixar studio in a few years later. From 1980s to 1990s, computer technology kept developing and 3D animation started to gain commercial success. In 1992, to make the film *Jurassic Park*, Lucas's company ILM took the advantage of 3D animation and composited the computer generated dinosaurs with live action, this film won the Academy Award for Best Visual Effects. In 1995, Pixar studio produced their first whole CG feature animation film *Toy Story*, which revealed the new chapter of 3D animation. Since then, video game industry, scientific area, advertising and the other mediums were exploiting 3D animation in their production, which greatly enriched 3D animation industry.

4. 3D and Stop Motion Animation Techniques Analyses: Similarities and Differences

4.1. Adjusting Model Methods

For Stop motion animation, the animator will manually adjust every pose of the characters and use monitors to check the movements between the closed frames. If the character needs to do a jump, the animator will find a rig attached to it and support its weight. Due to the gravity principle, the animator sometimes have to use some tie-downs to keep the model stable on the stage. In addition, the stop motion animators also developed their tools for adjusting the model in the animation making process. The stop motion animator Tim Allen stated that they would use a dob stick, a piece of steel (Eduplastilina 1:36- 2:27) [5]. This tool will help the animators to create subtle movements of the puppets by putting one side of the stick to the center gravity of the puppets and another side to the ground. So the animators can push or pull the stick to get tiny movements for the puppets. For 3D animation, the animator only need to control the rig in 3D software. The rig is equipped with controls that allows the animator to drag them and change characters' pose. When the gesture is settle down, the animator can select all the controls and key the position of the model and the data will be recorded in the 3D software. If the animator wants to change some poses later, they can return to polish these key frames and change them directly. In addition, some 3D animators and studios also use 3D software plugins to store or manage their animation. These plugins are similar to a library that could keep many key poses of characters. Therefore, it could help 3D animators to block their animations quickly and work more efficiently.

On the contrary, stop motion animators don't have this luxury to change the gesture freely if the animation sequence is finished. 3D animators also can use graph editor to adjust the timing and spacing of the animation. This editor enables them to create some precise movements, including slow in and slow out, overshoot and testing the scene's rhythm.

4.2. Camera Moves

In CG animation, the artists can create a digital camera in 3D software, so the animators are free to move camera at any place in the scene. They can adjust and key the camera as they are animating the characters. By using graph editor, they could speed up or slow down the camera movements. For some complicate and smooth camera movements, the animator can use the curve tool to create the path and attach the digital camera to it. Nevertheless, the camerawork in stop motion animation is a tough part. As the stop motion animator Barry Purves mentioned in one of his book, if a camera move were to adjust to every change in speed of the animation it wouldn't flow (Purves, 181) [6]. For the stop motion animators, they will need to cooperate precisely with the cameraman, otherwise the character's movements would probably go back and forth, which will distract the audiences. So what the stop motion animators will do is to do a great planning for the camera movement in early stage, and match the characters to the camera speed.

4.3. Shooting on Ones and Twos

In animation industry, it is controversial that if shooting on ones is better than shooting on twos. Shooting on ones and twos (TIFF 0:00- 0:58) [7] means that you either take one frame of the movie per motion or two frames of the movie each motion in the action (Figure 2). In 3D software, when you key an object from one place to another place, it will generate a smooth transition by default. This feature strongly influences how CG animation looks. For example, the 1995 *Toy story* is shooting on ones, which is 24 frames per second. It helps to show a lot of motion details about the characters. However, for a stop motion animation, the shooting solution can be vivid. Some stop motion animators choose to shoot on twos or threes for budget and efficiency issue. For Aardman studio, Dug Calder who is working in Aardman states that they prefer shooting on doubles, unless the character moves fast, they will shoot on ones (Purves, 156). Besides that, you will find some stop motion are shooting on ones. For example, the Laika studio's films and the stop motion animation films made by Tim Burton are good examples to illustrate this point in the early times. It seems that both methods are good to use as long as they fit to the story style.

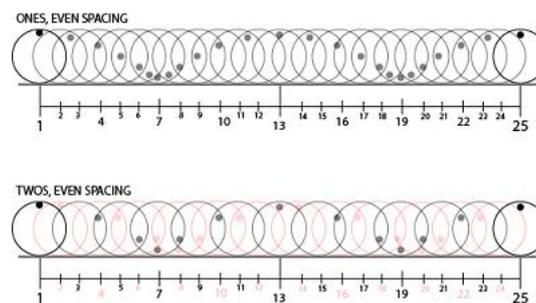


Figure 2. Shoot on Ones and Twos (Gromek).

5. Stop Motion Animator's Techniques

5.1. Hands-On Process

Sayoko Kinoshita, the organizer of the Hiroshima animation festival indicated that the stop motion animation created by the animators' warmth hands has the magic to communicate the characteristic so that the other animation doesn't have (Purves,

35)[8]. The human touch plays an important role in stop motion animation. If we look back to old time craftsmen's works, they don't have advanced technology, but they use their hands to change the simple materials to great sculptures or architectures. Nowadays, despite technology dilutes the connection between human beings and craft, we are still touched and marveled when appreciating craftsmen works. In 19th century, the Arts and Crafts movement's motto was 'Head, hand and heart (Cumming) [9], which can be related to stop motion animation. Hand-made feature is where stop motion animation is unique, because it inherited this craftsman spirit. The handmade quality is through all the process in stop motion animation. It is noticeable that when a stop motion animator is working on a shot, the animator is always standing, moving around or squeezing himself to adjust the pose of the model. The stop motion animator is fully using his or her instinct to make the animation. However, for CG artists, they could not touch their model personally, they are usually sitting in front of their computers and relying on the keyboards, digital pen and mouses to do their work, which is a more stationary work style. Therefore, it seems that the handmade quality enriches the aesthetic value to stop motion animation and the pure emotion and feelings of the animator are also being transformed to the puppets.

5.2. Working Mindset

In reality, we are always being influenced by our surrounding environment. We can tell what is real or not. To some extent, these things are also shaping how we think and behave. According to the previous research, we have already known most stop motion animators work in solo mode, which means the animator is in charge of every characters and props movements. This working method could take longer considering the camera or lighting problems. Actually, it is not an efficient work solution, but it gives the animator more time to immerse himself or herself to think about the characters' performance as a whole. Because for stop motion animation, the characters and props are real objects, the animator will need to accustom themselves to the set. Ethan Marak who is a stop motion animator mentioned that the energy of human interaction with the physical world is what the CG animation are missing (Purves, 202) [10]. This demonstrates that when animators are animating a stop motion animation or a CG animation, they might have different mindset. Physicality is playing the power behind this phenomenon, it also works for the audiences. Therefore, once the stop motion animator really can see and touch the character, it will better intrigue their instinct to finish the animation task.

5.3. Simplicity

The great architect Mies Van der Rohe presented "less is more" as his motto in 1947 ("Minimalism") [11]. In architecture, "less" means higher artistic pursuit to technique and structure; In that case, the architect can express and present the essence of the objects with their skills. "More" represents the deep consideration of details and need of functionality. This idea greatly influenced arts, including architecture, painting, music, literature and animation. For stop motion animation, we rarely see complicated and dazzling effects that computer animation shows good advantage. Instead, we will see the simple characters with strong human feelings. Adam Eliot's stop motion animation films are perfect examples to express the simplicity but also show a powerful characters at the same time. In his film *Mary and Max*, he chose to use clay as the main material and figured out a concise method to show the characters performance. Unlike the other animation that strength every movement of the

characters, Adam keep them stand and stare a lot (Purves, 157) [12]. This concept is also exploited by Aardman studio. In *A Shaun The Sheep Movie*, the animator choose to utilize simple action, for instance, characters blinks are commonly used to communicate the ideas since there is no dialogue in the whole film. In Wes Anderson's *Isle of Dogs* stop motion film, the stop motion animator Tim Allen discussed that the Wes style of movement is always direct and clear. Even though an experienced animator has to learn to not to put the commonly used animation tricks, such as overlapping and drag. Conversely, the current 3D animation trend is going to the other direction. The 3D animators put more energy to every details of the characters' movement to strength the believability. Sometimes, putting this details are good effort. Bur they could lose their vision in some cases. Therefore, simplicity appears to have a great referential value for the other animation forms.

5.4. Texture Movement

As we have mentioned in the first part of this research paper, stop motion animation is special for its various materials, making stop motion animation more diversified and interesting. In addition, the texture movements brought by hands on the puppet also boost the charm of stop motion animation. This trait adds extra richness of the characters' performance. For Claymation, it is clear that the finger prints showed on the model surface brings some tiny changes to the animation. It is unavoidable because the animators need to adjust the model by hand frame by frame. However, this could be viewed as a style of Claymation. If we look at the other types of stop motion animation, we might not see the finger prints, but the subtle texture movement is still there. This texture movement identifies that they are made by human hands, it also becomes to be a special narrative language of stop motion animation. On the country, CG animators may found themselves need to face the smooth and grey texture models when they are making a shot, which could block their inspiration and visions.

5.5. Stop Motion Animator's Challenges

The big challenge may come from the rise of digital technology. Because stop motion animation is still a labor consuming and complex production, the stop motion animator will usually spend more time setting up the scene. For example, when Aardman studio is shooting the film *Wallace & Gromit in The Curse of the Were-Rabbit*, they employed 30 animators and worked on 30 sets at the same time, this film took 5 years to complete, the scene vegetable garden consumed hundreds of vegetable and leaves, and it also costs plentiful clay. Such a great effort paid by the whole team, the animators can only produce 3 seconds stop animation per day (chuckthempvieguy 1:09-1:16) [13]. In addition, stop motion animation has strict requirements for the animators, they had to be really careful and focus on their work. Otherwise, they will remake the whole scene since there is no remedy for the mistakes when they are shooting on the shot.

On the contrary, the CG animators always can have the opportunities to make some adjustments about their animation later. And 3D technology shows more flexibilities on visual effects and simulation than stop motion animation. It's a fast and efficient workflow that will bring huge commercial benefits. Therefore, we can say this trend gives the stop motion animation a big challenge. But it also pushes the stop motion animators to explore the new methods for the future of stop motion animation. For example, Laika studio and Aardman studio have already utilized 3D printing

technology to help them to make their films, which is a great exploration (Noguchi 4:46-5:44) [14]. This interesting combination enlightens more and more artists to get into stop motion animation industry at the same time. If we look from this perspective, the 3D trend promotes stop motion animation as well.

6. Conclusions

The present study proposed several aspects comparisons between stop motion animation and 3D animation. Analyzing these similarities and differences would help us to understand the uniqueness of stop motion animation techniques. The aim of this research is not to use CG animation to replace stop motion animation, its goal is to see how stop motion animation techniques can enrich 3D animation and how to bring new ideas to Cg animation world.

The future researchers can do more cg animation tests with the stop motion technique on lip sync, effects and shape transformation animation. Another exciting area is exploring how stop motion technique can be brought to 3D VR set. The Cg animator will model and animate the character as stop motion animation artists do in reality. This will help to close the gap and it enables the cg artists to get closer to the characters and feel the characters. On the other hand, it can liberate the cg artists from the stationary work lifestyle and make them more energetic and creative.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

References

- [1] Gasek, Tom. *Frame by Frame Stop Motion : NonTraditional Approaches to Stop Motion Animation*, CRC Press LLC, 2011. ProQuest Ebook Central. Available online: <https://ebookcentral.proquest.com/lib/iadt-ebooks/detail.action?docID=4689069> (accessed on 15 March 2022).
- [2] Priebe, K.A. *The Art of Stop-Motion Animation*, 1st ed; Thomson Course Technology PTR, Boston, MA, 2007; pp. 05-10; 1598632442.
- [3] Maselli, V. The Evolution of Stop-motion Animation Technique Through 120 Years of Technological Innovations. *International Journal of Literature and Arts*, 2018, 6(3), 54-62, DOI: 10.11648/j.ijla.20180603.12.
- [4] Oppenheimer, R.; William, F.E.A.T. 1960s Computer Graphics Collaborations in Seattle. *ACADEMIA*, 2005. Available online: https://www.academia.edu/7801224/William_Fetter_E_A_T_and_1960s_Computer_Graphics_Collaborations_in_Seattle (accessed on 15 March 2022).
- [5] Eduplastilina, director. 6 Stop Motion Secrets Revealed by Tim Allen. YouTube, Available online: www.youtube.com/watch?v=RPkaYzDa5c&t=147s (accessed on 17 February 2019).

- [6] Purves, B. *Stop Motion: Passion, Process and Performance*. Focal, Slovenia, 2008; pp. 175-181; 978-0-240-52060-5.
- [7] Tiff, director. Shooting on “Ones” vs. “Twos” in Stop Motion Animation | MISSING LINK | TIFF 2019. YouTube. Available online: www.youtube.com/watch?v=QbZswIjjTDM (accessed on 2 May 2019).
- [8] Purves, Barry. *Stop Motion: Passion, Process and Performance*. Focal, Slovenia, 2008; pp. 30-35; 978-0-240-52060-5.
- [9] Cumming, E. The Arts and Crafts Movement in Scotland: A History Annette Carruthers. *The Journal of Modern Craft*, 2014, 7(3), 335-339.
- [10] Purves, B. *Stop Motion: Passion, Process and Performance*. Focal, Slovenia, 2008; pp. 175-181; 978-0-240-52060-5.
- [11] Britannica, The Editors of Encyclopaedia. “Minimalism”. *Encyclopedia Britannica*, 12 Mar 2020. Available online: <https://www.britannica.com/art/Minimalism> (accessed on 12 May 2021).
- [12] Purves, B. *Stop Motion: Passion, Process and Performance*. Focal, Slovenia, 2008; pp. 150-157; 978-0-240-52060-5.
- [13] Chuckthemovieguy, director. Nick Park Interview for Wallace and Gromit. YouTube. Available online: www.youtube.com/watch?v=FemNiUz1aS4 (accessed on 5 March 2008).
- [14] Brandon, N. The Effects of CGI on Stop Motion Animation. YouTube, Available online: www.youtube.com/watch?v=61gyYP6Z-G0&t=308s (accessed on 10 May 2020).



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