Study of Character Animation to improve Production Efficiency

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Abstract

Recently, webtoons-based animations have been expanding in Korea, where the role of mobile devices is growing, and media videos such as "YouTube" and "Tik-Tok," which have shorter screening and production cycles than traditional feature films, dramas, and animations, are attracting attention and being enjoyed by the public. In order to produce animation content that fits the trend of this shortening video and production cycle, efficiency must be increased not only in story but also in production. Production methods and production technologies need changes to increase efficiency. Animation using motion capture, which is highly production-efficient, is widely used in movies that shows realistic movements, but still has little use in producing cartoon-style animations with exaggerated movements. We analyzed the production method of 2D animation and CG animation and applied the result to CG animation to increase the efficiency of production and production. The methods of production through such experiments are expected to help improve the efficiency of producing animation content that is suitable for the latest trends such as webtoon animation.

Keywords: Animation Production, Animation Re-Timing, 2D Animation, CG Animation

1. Introduction

Disney animations in the United States have had a big impact on how animations are actively being produced in Asia. In the early days of industrialization, Japan developed its industry by creating content along Disney's animation production system. Japanese animation, which imitated Disney not only in the visual representation format of animation such as the number of frames per second for created images and the screen ratio, but also in the production system, soon hit its limits. Then, they switched to creating a system in which the role of a suitable creator was important, the production system, which values creators like 'sakuga', formed unique fandom effects that were different from those of the West in the 1960s [1]. In the 1980s, starting with 'The space battleship Yamato,' 'Gundam' and 'Evangelion' created the culture of otaku. Aesthetically high-quality work, such as "Ghost in the Shell (1995)" by 'Mamoru Oshii' and "Paprika (2006)" by director 'Satoshi Kon', has elevated the status of Japanese animation. Japanese animation has been recognized as the best 2D animation ever since, continuously creating outstanding works. In the system in which creators have become important, as mentioned earlier, creative artists have come to the spotlight and their style of drawing has become a unique style that represents "Japanimation" [2]. Limited Animation, a production method initiated...
by 'Osamu Tetsuka', leads to the artists' efforts to improve quality within a limited frame. The production method of limited animation, which was artfully sublimated by the ‘Yoshinori Kanada,’ is still being inherited and developed by many artists [3].

Korea, which has been relatively sluggish in the animation market, has recently seen a growing number of cases being made into movies or animations after the success of webtoons. With this phenomenon, it can be expected that various webtoon-based content production based on various storytelling will be activated in Korea. You can compare the animation of "Ito-Junji Collection (2018, Japan)" with "Native Resident Horror Cartoon (2020, Korea)" [4.5]. For example, based on the webtoon "Native Resident Horror Cartoon", the 2D animation seems to have a lot of similarities in the animation and image concept of "Ito-junji Collection," but the difference can be seen in the content of the work, with a horror storytelling structure consisting of relatively short lengths and containing comics well-represented the characteristics of the webtoon story structure based on the mobile generation. Animation "Native Resident Horror Cartoon" can see that it targets a wider range of audience exposed to mobile, and character animation is simpler and easier to watch. Like this, aside from the existing Japanese and American animation production methods, it is necessary to propose a way to produce animations that can be applied to new media such as mobile.

1.1 Cut-by-Cut production with 2D animation

If you look at the way 2D animation is produced in Japan, it is assumed that the character's movements are made using very efficient frame usage. Figure 1 is a series of cuts from the animation "Another (2012)." A quick cut transition is taking place despite the characters not moving, while the camera's composition has delivered enough stories to the audience. Effective screen production naturally guides the audience to understand the stories even if a character speaks without moving the relevant parts, when only the hair moves as if the wind blows, and when a half of a character's face is seen with certain camera angles.

In Japan's 2D animation, the cuts show certain rules. There are usually less than three key poses within a cut if you count the number of poses thinking about the beat. The character animation can be made very simple if a single cut is formed into three or fewer poses. Japanese animation, which began based on cartoons, has given importance to the imagination of the characters' poses with many cuts. Such differences provide ideas that can increase production efficiency. In order to make the animation simple, the cut can be shortened to reduce movement, or the psychological changes of the character can be expressed using the camera composition and movement of each cut.

![Figure 1. Another](https://search.yahoo.co.jp/image/search?rkf=2&ei=UTF-8&p=アナザー)

2. Analyzing Animation Production Rules

2.1 Timing of Motion based on Emotion by Cut

For Japanese 2D animation, the movements in the cut have a number of regular movements and timing patterns. We looked for cuts that showed emotions in the animations "Forever than the Universe (2018)" and "Akira (1988)" and analyzed the number and timing of each cut mentioned in the introduction as shown in Tables 1 through 4.
Tables 1 through 4 show three common points. First, there are two to three major cut-by-cut movements that represent the psychological state of the character. Second, there is a hold or moving hold between the movement and the movement, which clearly distinguishes the movement.

The hold is placed in the middle to stop the motion for a very short moment even in a motion that shows a psychological state in Table 4. Because it describes the state of feeling shocked, it shows how to emphasize the feeling of shock by cutting off the movement often and briefly.

Third, the beginning and end of the movements are usually within 15 frames (1/2 seconds), indicating that they are of similar length regardless of emotion.
Table 4. Timing according to the expression of shocked emotions

<table>
<thead>
<tr>
<th>Feeling of shock</th>
<th>the beginning of an action</th>
<th>stop of motion</th>
<th>Ho -ld</th>
<th>the beginning of an action</th>
<th>stop of motion</th>
<th>Ho -ld</th>
<th>the beginning of an action</th>
<th>stop of motion</th>
<th>Ho -ld</th>
<th>the beginning of an action</th>
<th>stop of motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>image</td>
<td>frame 1</td>
<td>13</td>
<td>8</td>
<td>22</td>
<td>31</td>
<td>45</td>
<td>56</td>
<td>67</td>
<td>81</td>
<td>105</td>
<td>134</td>
</tr>
<tr>
<td></td>
<td>length</td>
<td>13</td>
<td>23</td>
<td>22</td>
<td>38</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>feeling</td>
<td>surprise</td>
<td>discomposure</td>
<td>finishing action</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Reference Image: https://play.watcha.net/watch/mdEwqW)

If you produce a CG animation of an angry expression of emotion among the actions shown in the preceding table, the motion can be represented by a graph of the image above in Figure 2. Looking at the graph, the gap in motion length, which shows emotions within a second, does not express the movement too slowly or boring, and rapid changes give the movement a strong feeling. The image below in Table 3 shows a modified version of the motion timing to make it feel more natural. In CG animation, extending the interval between two or three frames of motion can create a more natural expression, as the motion appears to be noticeable in CG animation if there is a change in motion at one frame interval.

Figure 2. Keyframe Graph Blocking of Angry Emotions & Comparison of Detail Modifications

2.2 Timing of character behavior according to sequence directing

Japanese animation mainly uses the method of using cut-by-cut connections to increase the production efficiency of animation, as shown in Figure 1. It conveys to the audience the emotions the character feels through different camera cut connections, in which case the character's movements are generally minimized. This can also be applied to CG animation [7].

Table 5 shows three images of a man pulling a woman's hand and hugging her. In the same way we usually see webtoons or cartoons, we imagine that the characters are moving slightly as these three images are in succession. And the imaginary movement doesn't deviate much from the image.

Table 5. Motion production according to sequence directing

<table>
<thead>
<tr>
<th>image</th>
<th>cut 1</th>
<th>cut 2</th>
<th>cut 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CG animation</td>
<td>image</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
We only imagine a slight shift in motion. You can see that making these imaginations into CG animations and delivering actions through sequence production makes each cut simpler. Table 5 shows that a total of 100 frames of animation is almost made of only key poses. This method shows the advantage of being able to increase production efficiency by dividing actions into connected sequences through cameras when producing animations.

### 2.3 Applying Short Animation

Table 6 is one of the animations using motion capture, and the motion data of 300 frames was modified to produce the final 220 frames. This is a scene where a delivery man runs past a motorcycle to the left, then runs back to the right side of the screen, opens the box, puts food in, jumps and rides a bike. The original motion data is not as exaggerated as the pre-modification image and appears as a realistic behavior. Looking at the post-modification image, the character places his hand on the box with an exaggerated gesture, flies the body in the reactionary motion, and rides on the bike vigorously. What's more important than a pose is the timing between the movements, and as mentioned earlier, cuts always require binding between characters, or between objects and characters. Thus, the timing adjustment of motion is always done before the original motion data is modified, and then the detailed modification and the constrain process must be carried out afterwards if the correction timing is necessary to process.

<table>
<thead>
<tr>
<th>pre-modification image</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>original frame</td>
<td>1~130(129)</td>
<td>131~214(83)</td>
<td>215~300(85)</td>
</tr>
<tr>
<td>Image After Modification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modified corresponding frame</td>
<td>1~89(88)</td>
<td>90~171(81)</td>
<td>172~220(48)</td>
</tr>
<tr>
<td>Interaction status (Constraint force)</td>
<td>Open and close the bag/ Grab the bag and jump</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Reference Image: kamiwaza sakuga, kadokawa)
3. Conclusion

With the production formats of TV and movie theaters being produced as content for OTT services such as ‘YouTube’, ‘Netflix’, ‘Watcha Play’, and Disney Plus, new formats are emerging, shorter running times and more demands are being made to reduce the production period. Under these circumstances, it seems necessary to improve production efficiency while maintaining the proper quality that can be realized while watching the work. In order to find and utilize the strengths and weaknesses of the existing content production and to continuously utilize motion capture data that is still underutilized in Korea, we added a process that easily modifies the operating timing and produced prototypes. We will have to continue to try and put new styles of works on the market just as Japan copied Disney Studio's production system and style of works in the early days, but has since come up with a Japanese style and system. In the future, in order to enable real-time animation production, We plan to add a study to implement facial capture through mobile.

References