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Research paper

Focused on multi viewed virtual reality short film 'sweeney TODD - the story of a barber' production study

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Abstract

Background/Objectives: The Virtual Reality realistic image content is a technology to enable building imaginary space by synthesizing both real and graphic images so as to provide the sensation of immersion without the distinction between real and virtual world. In addition, this is a realm with strong growth potential requiring the raise of technological maturity in the medium to longer term.
Methods/Statistical analysis: This research is an attempt to study the time and structure to acquire multi-view components beyond the degree of simple technological experience of delivering the already constructed information unilaterally. In addition, the direction to selectively solve the key problems in VR image grammar is explored by considering the pipeline of production technology including time control, etc.
Findings: In this study, we have examined the necessary element for production such as the actor's movement, lighting, space set for postproduction stitching and issues that arise in direction by actually producing the VR 360 image in real life. We realized that in the view point of VR 360 image, more than the camera angles, the mise-en-scene and space coordination according to the actor's movement is more important.
Improvements/Applications: VR visual grammar's liberal point of view has the potential to become a specialized genre where it can extend as a new genre by breaking free from the square frame and specialized format

Keywords: *Virtual Reality; 360 Realistic Image; Technology; Pipeline; Multi-View*

1. Introduction

The success of 3D movie "Avatar" at the end of 2009 opened the doors for 3D movie contents and this brought about related hardware development and propagation of functions. Today, 6 years has passed and the 3D market in the movie and TV broadcast industry has shrunk.
When YouTube started their 360˚ virtual reality image service in 2015, the virtual reality gained some recognition in the contents market within various genres but absence of its own established independent visual grammar and video contents customized to the virtual reality storytelling still has the audience find the virtual reality foreign and alien. These days there are spread of the smartphone-coupled type HMD (Head Mount Display) and applications that work as a platform but related images are still at the test and experience level that they lack contents with the quality and design powerful enough to extend to the general audience. Recently, big and small companies like Google, Microsoft, Sony, Samsung and LG are studying VR technology which brought the audience's attention upon it [1].
Virtual reality image content is a field with great potential that we need to perfect the level of its completion on mid to long terms. It can synthesize a virtual world by combining real life images with graphic to blur away the boundaries between the reality and virtual world and therefore is a mixed reality technology - a complex of reality and virtual information [2].
VR (Virtual Reality) and AR (Augmented Reality) both have intense technological characteristic but from the user's perspective, the difference is clear. AR is more of inserting virtual object that does not exist whereas VR is close to experiencing it [3]. With such personality VR serves as more entertaining factor and AR serves as productive and industrial tool. However, their definition and _ have not been fully developed worldwide which makes for confusion.
This study examines the issues that arise in the entertainment VR 360 ˚ short film production pipeline and its production technology and effective methods that follows. Extending away from the mere experience of technology delivering pre-coordinated image information from a single perspective, our objective is to find a way to effectively produce image content that allows for diverse perspective based immersion with changing views while watching images that can carry compositions from various perspective.

2. Materials and methods

2.1. 360 Virtual reality image contents

Virtual reality image contents are more than simply watching the image; it refers to continuing the direction or story line by stepping into the image realized in the virtual world.
Virtual reality image contents are more than simply watching the image; it refers to continuing the direction or story line by step-

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ping into the image realized in the virtual world as shown in figure1.

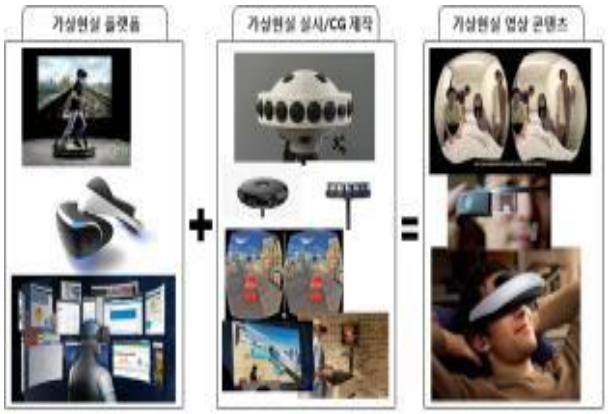


Fig. 1: Virtual Reality diagram.

By adding instruments like a motion simulator to give physical immersion, virtual reality image provides immersion that will give joy and impress the audience depending on the direction or story. The audience can experience optical illusion as if they are really in the scene of the image as they watch the virtual reality image in 360 ˚ screen.

2.2. Cases of VR short films

Virtual At this point, where 3D movie is losing its place, the virtual reality contents market is on the incline and corporations, production, and researchers in in high hopes are attempting to preoccupy the field of virtual reality contents.

Centering around the Archeological Reminiscence of Millet's "Angelus", the art piece of surrealist painter Salvador Dali, the Dreams of Daliin figure2 was produced into VR 360˚ image where the audience can step into the world of Dali.



Fig. 2: Dreams of Dalí: 360º Video.

This piece begins, in Dali's conversation, with an adult and a child in silhouettes. The child is Dali and the adult is his father. The one who is experience the dream of Dali becomes the observer of this world, a visitor and surreal third person. Behind the statue that appears, there are four enormous elephants with long legs. They appear in Dali's other work. In addition, the girl skipping rope is from Dali's work in 1936, The Girl Skipping Rope[4].

In the Sundance Film Festival, which is an international film festival held in Utah, U.S.A., many virtual reality image contents appeared and the New Frontier section initiated the virtual reality, which grabbed the audience's attention. VR 360 short film was confirmed in the Sundance that it can sufficiently deliver intense story in short film form.

In figure3, <Perspective; Chapter I: The Party> by Rose Troche and VR pioneer Morris May director is the example. This film is deals with date rape, which is seen in two different viewpoints where the first is in the male's first person view and the second in the drunk girl's. The audience who watched this film through VR found the topic very heavy and constantly moving camera made them feel sick afterwards[5].Troche said that "it is amazing to be able to make a whole new world with VR where it's not just a trick or a platform but actually creating a world for the audience to experience or intentionally give limit to it. There's no way back. VR is going to be a new form of movie".



Fig. 3: Perspective; Chapter I: the Party.

2.3. VR film storytelling

The biggest change the virtual reality image gives to storytelling is the 'reinforced reality'. In the virtual reality environment, the audience is not just watching the directed scenes but steps into the very moment and experience it. The virtual reality image requires no frames or camerawork like switch of screens such as the close-up and the player enters into the virtually existing world to become the actor on stage. The participating audience or virtual avatar or anyone can become an actor.

In virtual reality 360 image, many areas applied in existing image are being altered and eliminated. There is no standardized environment or specification to virtual reality 360 image. This means such environment requires the producers to accommodate image information that did not exist before. The role of lighting and sound became more important in order to direct attention to the scene. One of the issues arising in virtual reality 360 is the motion sickness which comes from the difference between what one actually perceives and action played[6].However, this can be improved if it is produced to suit the characteristics of virtual reality machine. It would be adequate to show scenes in a complicated image slowly as if it was taken in slow motion so that one can view it in detail. Another limit VR 360 image has is the existence. For example, the staff has to hide themselves when filming 360, pay attention to connecting lines, and the director and actors have to coordinate well with the staff as most of the times they go with one take.

2.4. 360 Degree camera

The camera system used in actual image VR image filming is largely divided into the rig type and all-in-one type as show as seen infigure 4 and 5.



Fig. 4: LG 360 Camera.



Fig. 5: Gopro Rig Type Camera.

All-in-one type has more than one fisheye or wide angle lens mounted on the body in order to increase the convenience in filming unlike the rig type. There are Kodak SP360, Samsung, LG 360Cam, Bubble, Nikon, Nokia, 360Fly and connects to Wi-Fi or remote to film. All-in-one type does not have the quality of rig type VR filming camera but looking at the specifications of recently launched cameras it seems like the difference is closing off.
Rig style 360 filming camera has at least 6 cameras attached to fixed rig in order to film in all direction - up, down, left, right, back, front. Minimum 6 to 10 cameras like action cams and DSLR are attached on the rig. High quality 360 video can be made using the rig style. Compared to all-in-one type 360-degree's filming camera, rig type utilizes number of cameras which means more pixels and resolution. Resolution over 4K or commercial ad 360-degree videos more than often use the rig style 360 filming camera. 360 VR image films the views in each direction at the same time and use the software to connect them together. Because 360-degree video takes all possible views from every direction, the person filming inevitably gets inside the frame. Placing the 360-degree video filming camera right above the taker's head or using a small tripod to film remotely will reduce this error. The yet to be developed technology of the 360-degree video allows for many variables to arise in the production process. In existing contents, filming element is important to keep the square frame by zooming in and out of the screen from different angles. On the other hand, the 360 image contents films head to toe and is not limited to square frame, coordination of many cameras and stable system management is more important than existing filming method.

2.5. VR 360 film production technology

Virtual reality image has to provide 360-degree screen view that surrounds the audience which differentiates itself from regular image production in that it has to be able to provide information on 360-degree screen.
Virtual reality 360 image contents production method can be divided into two which are the stitching after filming with rig or all-in-one type cameras and producing with 3D computer graphics. It's also possible to combine the two. The recent virtual reality contents with gears like motion simulator, which allows for real experience, pursue production method that permits real time interaction by using game engines like 'Unity 3D' or 'Unreal engine' [7].
360-degree image filmed with all-in-one type camera records it in a format almost like that of the panorama. Turning this into 360-degree view with exclusive software or with software included with the product allows for anyone to watch virtual reality image on PC or smartphones.
When rig type camera in figure 6 is used in filming, it requires the stage called stitching to combine all images into one image. 'AutopanoVido' is the most used program at the moment as the virtual reality pipeline is not standardized yet. It has a function that unifies the start point of each image clip, synching them based on the moving motion and slate sound. Simple edit is possible but not detailed editing or detailed computer graphic works like the existing editing program which works as one of its cons. Due to such drawback, when producing it professionally people use computer graphic technology that is currently used in existing postproduction.



Fig. 6: Gopro Rig-Type Filming.

In virtual reality image contents production, camera setting is very important. You can either put cameras into a dome, set it to 360-degree screen, and export after stitching into a panorama or locate the image on the virtual hexagon made by 6 cameras, stitch and render into 360-degree virtual reality image. For virtual reality 360 image, it is critical to locate cameras differently based on the person's movement or space because it films the entire space at once. Arrange it into a circle if there are many people and therefore complicated movements and a square if filming for concerts[8]. Arrangement of camera undergoes the process of stitching that connects all separated screens and it can be distorted if an error occurs when overlapping the lines of images. When filming, you should consider that image filmed in distant view is easier to stitch but when a person is close to the screen, the images may not perfectly coordinate in details. Also, people moving fast getting on the stitching line can distort the image and makes the stitching process difficult [9]. Therefore, the skill of editing the image without any awkwardness even when movement and person pass close is thought to be the know-how in VR 360 image.

3. VR film 'sweeney TODD – the story of a barber' production

3.1. 'Sweeney TODD – the story of a barber' production vr 360 film production technology

Table 1: Initial Set of Features Used for the Experimentation

Title	Sweeney Todd – The Story of a Barber
Synopsis	A scene from the 'Sweeney Todd' by 'Stephen Sondheim', which started from the urban myth of a demon barber. Sweeney Todd, the barber, takes a revenge on his enemy, Judge Turpin which makes for a violent yet beautiful scene. Genre of musical is not a very approachable one. What if the user can experience the actor's performance on 1:1 in the middle of the stage?
Purpose	We are to recreate the stage, a very limited space, and reinterpreting musical in this new space through VR contents. Our objective is to examine the issues and possibility in image contents by creating one that can provide experience different from existing short film and potential in VR short film that is seen from various viewpoints.

3.2. VR 360 set depending on the direction

3.2.1. Pre-production

This virtual reality 360 short film films only the acting of the actor by organizing the the studio space into chromakey set instead of utilizing the local place or space. Its post production involves computer graphics for background and effect as shown as figure7.

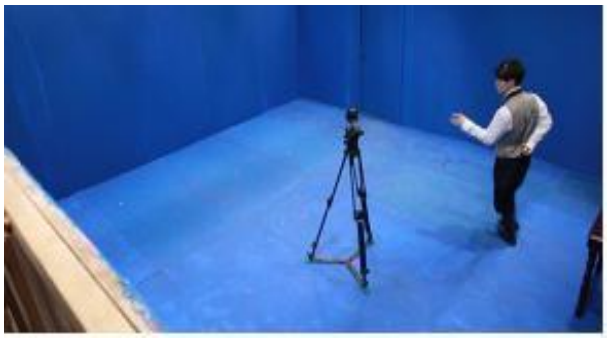


Fig. 7: Chroma keyset for VR Filming.

Filming space was produced as a set that is entirely covered with chromakey system except for the surface that which would be the top in a square. We constructed the mise-en-scene by placing props necessary to direction within the space and customized the lighting composition to not shadow over the props or actors' movement as shown as figure 8.



Fig. 8: The Lighting Setting.

3.2.2. Production

In VR 360 filming camera, there is no function of zooming in and out from different angles and so we had to alter the setting periodically to coordinate the location of the camera, viewpoint of the actor and lighting in all scenes except for full shot. This was very contrasting to the process of existing film and thus it elongated the filming time for the staff. The arrangement of lighting according to the actor's movement as seen in figure 9 is very critical because this utilizes the entire space. Lighting undergoes the post production based on the chromakey and so it is important to avoid bleeding of colors into the actor, background, or props through even lighting and handling of the shadow.



Fig. 9: Actor's Movement.

We set the screen to 4:3 proportion when filming VR 360 image with 6 GoPro cameras mounted on the rig type camera. It is necessary to place 360 cameras to partially secure the overlaps between cameras in order stitch them in post production so that intersections don't look awkward. Here, the lighting when the actor passes by the cameras, color temperature, movement speed and more affect the coordination of image. Therefore, for an effective coordination, we considered panorama composition by soft-edge blending the out-corners of the 6 images.

3.2.3. Post- production

'Sweeney Todd - The Story of a Barber' was filmed by moving the camera according to the 1st person actor's movement. With many full shots included, they were proceeded with the process of post production on mind.

This image production was being produced at around 4K resolution but we estimated 1.5K considering that a human viewing angle is on average 150 degrees as seen in figure10. However, the actual perceived resolution was much lower than this and so it has to be at least 8K to watch in the generally watched HD quality.

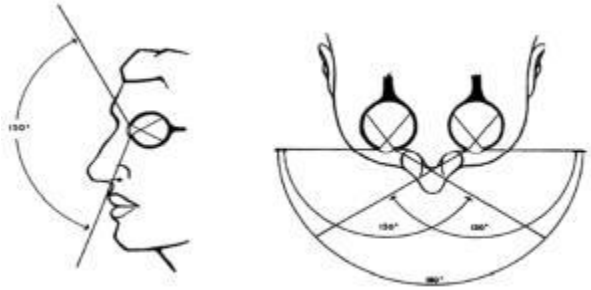


Fig. 10: Human Viewing Angle.

Premier Pro CC from Adobe added a new function that includes automated VR recognition in their VR editing tool and automated camera recognition function adopts the CG right for the user through VR image analysis[11]. After stitching using the familiar After Effect and extension program Skybox, we added background texture of matt painting and adequately set the 3D object on the virtual camera before composing the image. Also we created the dreamy ambience in the background by effectively composing real picture, graphic images and FX. In addition, we used the Keylight which removes the chromakey and also a combination of many different effects where we separated layers of background and the actor from each other.

4. Conclusion

VR image contents has very different image visual grammar from existing image. The user is free in viewpoint selection and can increase immersion in the virtual space created by 360 image. But on the other hand, there is a risk of distortion or missing out on the information of story composition intended by the director. Thus, in VR image content, it would be very important to compose the flow of view with mise-en-scene or induce user's attention by effectively placing the categories of interest in the development of the story in order for a clear understanding of the director's intended viewpoint.

In this study, we have examined the necessary element for production such as the actor's movement, lighting, space set for post production stitching and issues that arise in direction by actually producing the VR 360 image in real life. We realized that in the view point of VR 360 image, more than the camera angles, the mise-en-scene and space coordination according to the actor's movement is more important. VR visual grammar's liberal point of view has the potential to become a specialized genre where it can extend as a new genre by breaking free from the square frame and specialized format

5. Acknowledgment

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