Experiments with Stereoscopic Videos

Design Research Seminar Report

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Declaration sheet

I declare that this written submission represents my idea in my own words and where other's idea or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/ source in my submission. I understand that any violation of the above will be cause for disciplinary action by the institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Signature Naveen

Name of the student Naveen Kiran

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Date 27th June 2011

Approval sheet

The Design Research Seminar 'Experiments with Stereoscopic Videos' by Naveen Kiran is approved in Partial fulfillment of the requirement for M.Des. Degree In Animation & Film Design.

Guide T. Phani

Ext. Examiner _____

Internal Examiner _____

Chairman _____

Acknowledgement

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Contents

Abstract

My design research project is an attempt to understand the technical details and nuances of Stereoscopic videos. Stereoscopy is a very fascinating subject. It has a history of 100 years and various techniques and methods have been evolved to enhance the quality and experience of 3D depth. Today most of the animation films and live action films are being released in stereoscopic 3D medium as it has been become a very important key factor in the commercial success of the film.

In this project I aim to get a close look of various methods to create stereoscopic videos and also do some experiments with these methods.

Introduction

Stereoscopy deals with the two dimensional drawings images and videos when viewed with both eyes appear to exist in three dimensional space. When two offset images of same scene are presented separately to the left and right eyes of the viewer, they are combined in the brain to create a perception of three dimensional depths. These offset images are taken from two slightly different angles that correspond to the angle of vision of the eyes of the viewer looking at the object. Also eyes may perceive these images from two different image sources combined through eyeglasses, from a single source, split and separated to each eye through eyeglasses. Stereoscopy was introduced by Giovanni Battista della Porta (1538-1615), and Jacopo Chimenti da Empoli (1554-1640) who produced binocular drawings side by side which clearly indicated their understanding of binocular vision.
First publicly shown stereoscopic movie was “L’Arrivee du Train” by the Lumiere brothers in 1903 in Paris. Later in 1950s when the movie industry had to contend with the growing success of television, three dimensional movies emerged as a gimmick to get patrons to return to the theaters.

Phenomenon

Human beings like most of the other creatures have binocular vision (equipped with two eyes), situated close together and side by side. This positioning means that each eye has a view of the same area from a slightly different angle.
The brain takes the information from each eye and unites them into one picture, interpreting the slight differences between each view as depth. This produces a three-dimensional picture: one with height, width and depth.

It is the added perception of depth that makes 3-D, or stereoscopic, vision so important. Certainly, stereoscopic vision is vital for seemingly simple actions such as throwing, catching or hitting a ball, driving or parking a car, or even just threading a needle. It is not that such tasks can't be managed without 3-D vision, but a lack of depth perception can make these everyday tasks much more complex.
Basic principle behind stereoscopic videos or images is similar to the function of two eyes and brain. Images are taken from two cameras slightly apart from each other. These images are blended together or placed side by side. when viewers look at these images their left eye is restricted to see image taken from left camera and right eye is restricted to see the same taken from right camera. These information are combined by viewer's brain and creates an illusion of a three dimensional image.

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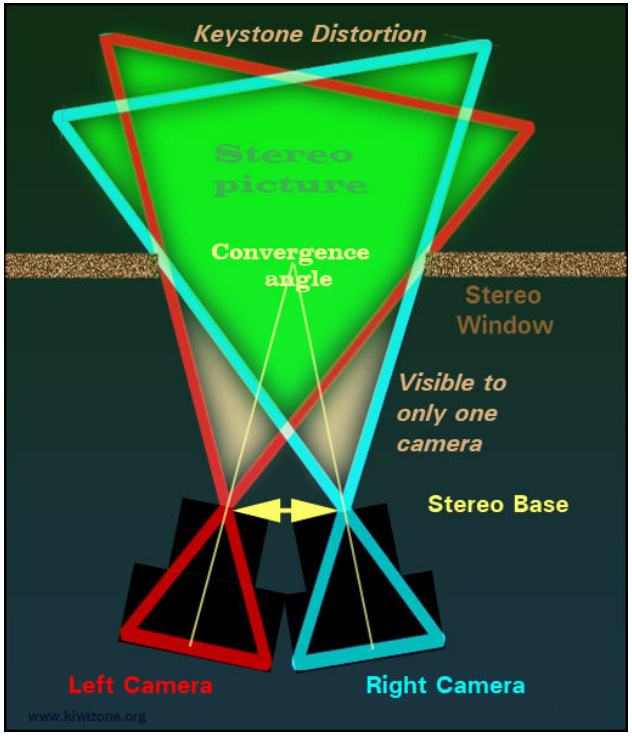

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Some Basic Technical terms

Stereoscopic 3D
For many people the term 3D refers to the CGI Modeling. But stereoscopic 3D deals with the sense of 3rd dimensional space in a two dimensional surface.

Interaxial and interocular separation
The interocular separation technically refers to the distance between the centers of the human eyes. This distance is typically accepted to be an average of 65mm or roughly 2.5 inches. Interaxial separation is the distance between the centers of two camera lenses.

Stereo Window Screen Plane
The Stereo Window refers to the physical display screen. If we assume this display screen as a window in a wall through which we can see outside world. Objects in the stereoscopic image or video can be behind the window at the window or in front of the window.

Binocular vision
Binocular vision means that two eyes are used in the vision system. Convergence and binocular vision are used by mammals to perceive depth at close range (300 feet). The wider an animal's eyes are apart, the deeper its binocular depth perception (depth range).

Disparity
All the disparities (vertical, rotational, zoom, keystone or temporal) other than horizontal disparity are bad for S3D. Horizontal disparity is essential and is called horizontal parallax.

Ortho-stereo, Hyper-stereo & Hypo-stereo

When average interocular of (2.5 inches.) is used as the inter axial distance between two shooting cameras then the resulting stereoscopic effect is known as “Ortho-stereo.”
If the interaxial distance used to shoot is smaller than 2.5 inches then you are shooting “Hypo-stereo.” This technique is common for theatrically released films to accommodate the effects of the big screen. It is also used for macro stereoscopic photography.

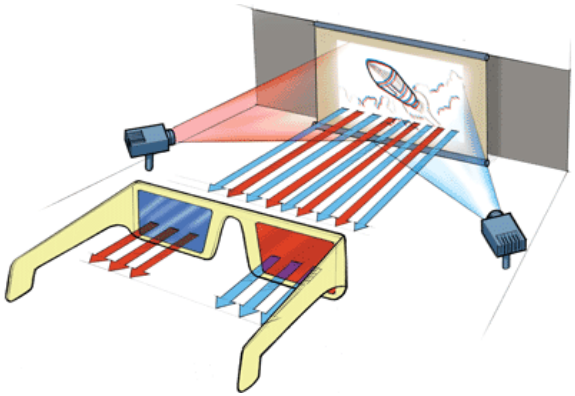
Hyper-stereo refers to interaxial distances greater than 2.5 inches. The greater is the interaxial separation, the greater the depth effect. An elephant can perceive much more depth than a human, and a human can perceive more depth than a mouse. Decreasing the interaxial separation between two cameras to 1” or less will allow shooting amazing macro stereo-photos and separating the cameras to several feet apart will allow great depth on mountain ranges, city skylines and other vistas.

The 1/30 Rule.

The 1/30 rule refers to a commonly accepted rule used by amateur stereographers. It says that the interaxial separation should only be 1/30th of the distance from your camera to the closest subject. In the case of ortho-stereoscopic shooting that would mean your cameras should only be 2.5” apart and your closest subject should never be any closer than 75 inches (about 6 feet) away.

Interaxial x 30 = minimum object distance from the camera.

The 1/30 rule doesn’t apply to all scenarios. In feature film production destined for the big screen typically a ratio of 1/60 or 1/100 will be used. The 1/30 rule works well if final display screen size is less than 75 inches wide, cameras were parallel to each other, and shots were all taken outside with the background at infinity



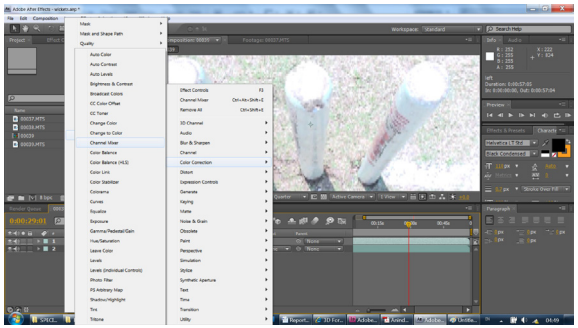
http://science.howstuffworks.com/3-d-glasses2.htm

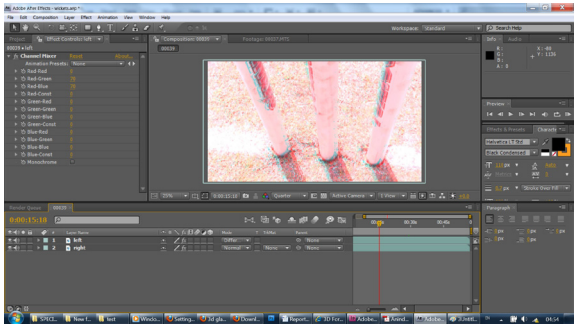
Various Methods

Most popular methods to view stereoscopic images or videos are red cyan filter glasses (anaglyph images) and polarized filter glasses.
Videos from left and right camera are converted to red and cyan. Then they are supreme posed and viewed through a glass having filters of two different colors red and cyan. Glasses with colored filters in each eye separate the appropriate images by canceling the filter color out and rendering the complementary color black.

To present a stereoscopic motion picture, two images are projected superimposed onto the same screen through different polarizing filters. The viewer wears low-cost eyeglasses which also contain a pair of polarizing filters oriented differently (clockwise/counterclockwise with circular polarization or at 90 degree angles, usually 45 and 135 degrees. As each filter passes only that light which is similarly polarized and blocks the light polarized differently, each eye sees a different image.

Lenticular or barrier screens
In this method, glasses are not necessary to see the stereoscopic image. Both images are projected onto a high-gain, corrugated screen which reflects light at acute angles. In order to see the stereoscopic image, the viewer must sit within a very narrow angle that is nearly perpendicular to the screen, limiting the size of the audience.





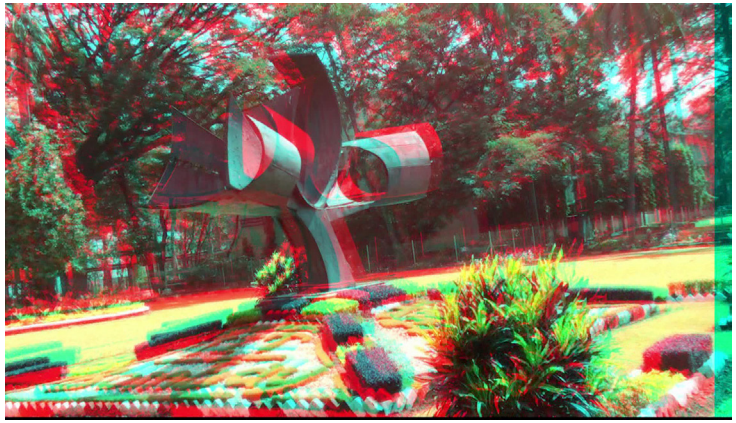
A simple method to convert footage to S3D video.

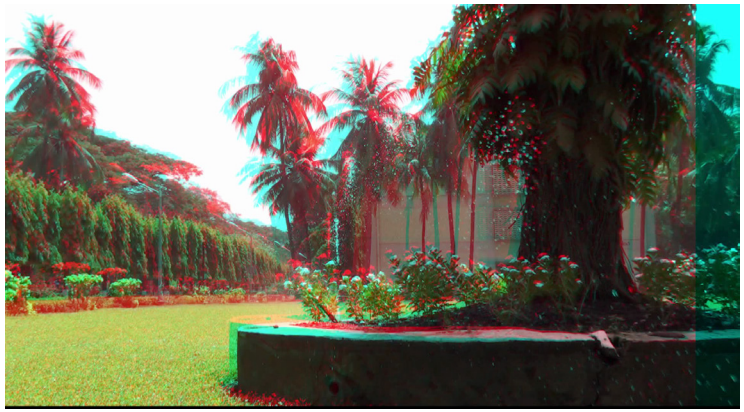
1. Get footage shot from two adjacent cameras.
2. Import them to after effects.
3. Bring both the footage to time line. Keep the footage from left camera in upper layer.
4. Right click on the left camera footage and go to effects>color correction>channel mixer. Set the red green and red blue values to 70 and keep all other values to 0. This will turn the video into red. 5. now right click on the right camera footage, go to effects>color correction>channel mixer. Keep the green green and blue blue values to 100 and set all other values to 0. This will turn the right camera footage to cyan.
5. Again do right click on the left footage, go to blending mode and set it to deference. It will blend both the footage and make two layers visible simultaneously.
6. S3D video is ready. Take red cyan filter glasses and keep cyan filter on your right eye and red filter on left eye.

Experiments with the S3D Videos

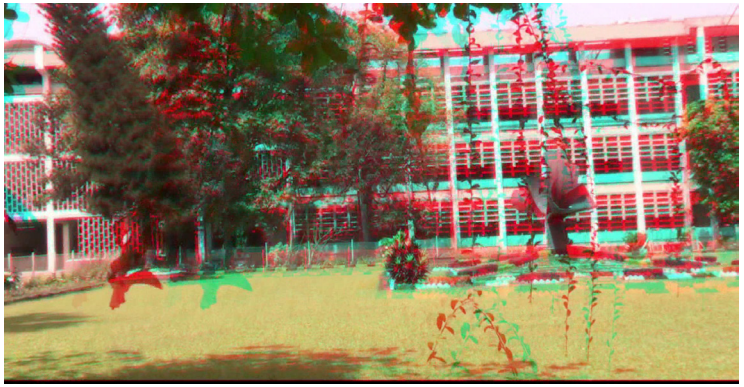
To achieve three dimensional depth, I conducted some experiments with the video using cameras, and after effects.

1. Creating two red and cyan layers of same footage.
I shot footage with single camera and made two layers of it in After Effects. After converting them to red and cyan, I slightly shifted the red layer towards left it acts as the left camera footage. The results were variable, depending upon the presence of 3rd dimensional depth in the scene. If the scene is flat then there is no sense of depth effect. And if the scene is in perspective or has various elements in different layers, then a sense of depth is created. This method is partially successful because depth effect between the object can be created but feel of volume of the objects is absent.





2. Second experiment also was on single camera footage and it involved some advanced features of After Effects. Two virtual cameras were generated in After Effects and were targeted at the same point on the plane of the footage. Horizontal Interaxial separation was given in between the cameras. This experiment failed because the source of images for the virtual cameras was a flat plane which was a pre recorded video. But there is a possibility of creation of depth effect if objects in the video somehow arranged in different layers and arranged them in the virtual 3d space.



3. Third involved a constructed device which works as a steady cam, two cameras, and a slider bar for the cameras. Depth effect achieved with two cameras is wonderful. But there are many challenges as well. Like convergence, and disparity control. It is difficult to converge two cameras perfectly at a desired point or object. And until we know the distance between convergence point and cameras, interaxial separation cannot be calculated. One option is to keep cameras parallel. Two cameras should be mounted horizontally. Slight level difference or change in orientation can create vertical and rotational disparity which can cause strain in viewer's eyes.

Conclusion

Though S3D films give a spectacular visual experience, creating such videos is very simple. Nowadays very advanced techniques and equipments are available to produce quality S3D in the film industry. But we can still make our S3d films with very easy, cheap and effective methods. Watching a S3D video itself is visually stunning; and if used creatively it can add flavors in storytelling. In the virtual world of video games, this can also increase involvement of the player with the environment.

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