Stereo rendering demystified

Author: itsikw

Tools Needed

* DAZ Studio
* Stereophoto maker

Support Files

*Stereo_camera_38x30x60.zip *camera.zip

Introduction

This tutorial teaches how to make stereoscopic images from 3D scenes using a new tool: the Stereo Camera. Shooting with the Stereo Camera is easy and fun, and full success is guaranteed in the first shot. Framing the object with the provided Stereo Window automatically positions the left and the right cameras in space, thus determining both the intercamera separation and the shooting distance. The Stereo Window also marks the boundaries of the final stereo image, thus serving as the stereoscopic viewport. The Stereoscopic Camera is a complete tool for shooting stereoscopic images. It was made for a 19" monitor with display size of 38x30cm (actually 37.5x30cm), and viewing distance of 60cm. To emphasize this we added the string '38x30x60' to the stereoscopic camera name, although we will refer to it simply as 'Stereoscopic Camera'. With the help of the Stereo Camera you will be able to free your mind from tedious technical chores, and focus completely on composition and art. Full color display of a stereoscopic image requires special equipment, which may not be readily available to most readers. However, if one agrees to compromise true color perception and to put up with a certain amount of visual fatigue, one can use the anaglyph display method to view stereoscopic art. The anaglyph is a standard image, and can be displayed with any software capable of displaying images. Any monitor can be used to display an anaglyph image. The only extra equipment needed for viewing is a cardboard red/cyan eyewear. In order to create the anaglyph from your stereo renders, you will need an external software. There are several software packages capable of creating anaglyphs. My favorite is StereoPhoto maker that is available from StereoPhoto Maker (English) by Masuji SUTO (a Freeware program). I used this software for the examples in this tutorial.

Step 1: Adjust your render settings

Choose the settings shown in the figure for this tutorial. The 16:9 preset of the active viewport is necessary to accommodate the shifted frames of the two cameras. The pixel dimensions and the render speed may be altered.
Step 2: Open the Stereo Camera

Open the Stereo Camera, and choose “camera center” for the active viewport. The active viewport should look as shown in the figure:

Before proceeding, let us ourselves with the Stereo Camera and its components.

Under Stereo Camera you will find two subcomponents: the Stereo Window and the Cameras. The Stereo Window is a frame made of four cylinder primitives outlining the edges of the final image (in this case a 19” monitor).

The Cameras subcomponent contains three cameras: left, center and right. The left and the right cameras are used for the stereoscopic rendering. The center camera is used for composition.

All transformations must be applied to the Stereoscopic Camera only. The subcomponents must not be modified. In order to avoid accidental modification, the transformations of all sub-components have been locked.

All three cameras are located 60 cm from the Stereo Window plane, with optical axes parallel to each other and perpendicular to this plane. The center camera is aligned with the Stereo Window center. The left and the right cameras are horizontally shifted by 3.25 cm with respect to the center camera to the left and the right sides respectively. Thus the distance between the left and the right cameras is 6.5 cm, which is the average human interocular distance.

Step 3: Merge the scene

We will illustrate the use of the Stereo Camera on the DAZ Studio demo scene Fairy Daytime. After merging it, the active viewport will look as follows:

Our Stereo Window can be seen located at the scene origin, half buried in the ground just below the Fairy feet.

Step 4: Adjusting the XY translations

Suppose we want to photograph the Fairy face.

Choose the Stereo Camera object and translate it to y = 180. Then choose the center camera for the active viewport that should now look like this:
First we use the X translate dial to bring the face to the center of the frame. We have chosen X = 7. Then we fine-tuned the Y translation and have chosen Y = 182. The centered image now looks like this:

Now comes the crucial step of adjusting the Z dial. But before that, we need to explain the two fundamental stereo composition rules.

**Step 5: The stereo composition rules**

The Z value of the Stereo Window is chosen according to two rules.

The Z rule: Position the Stereo Window as close as possible to all visible points of your object. In other words, if the farthest visible point in the object has Z value of Z1 and the closest Z2, put the Stereo Window Z value in the middle between Z1 and Z2.

The Stereo Window rule: Do not let any object in the scene to obscure the Stereo Window frame.

In many cases it is impossible to satisfy both rules simultaneously. The Stereo Window rule has precedence; in other words, the best compromise of the Z rule should be sought, while adhering to the Stereo Window rule.

There are many other stereo composition rules, however these two rules are most important.

**Step 6: Adjusting the Z dial**

Inspecting the previous image we note that the farthest points on the Faerie's face are the ears, and the nearest point is the nose. Let us choose the top view for the active viewport and zoom in, to obtain the following view:

According to the Z rule we adjust the Z translation dial to position the Stereo Window in the mid-way between the Faerie's ears and nose:

The value of the Z translate dial is now -3.

In order to verify that there is no Stereo Window obscuration, we examine the object using the center camera:

The Stereo Window is fully visible so both composition rules are now satisfied. The scene is ready for the stereo render.
Step 7: The render

Choose the left camera for the active viewport. It now looks like this:

Note that now the object is a little bit off center. However the final stereoscopic image will look perfectly centered as seen through the center camera.

Now render this scene and save the render. Next choose the right camera for the active viewport. It should now look like this:

Render this scene and save the render.

Step 8: Opening the left/right images in StereoPhoto maker for adjustment

The raw images that we created need to be adjusted and converted to a stereoscopic format. There are several programs that can be used to accomplish this. My favorite is StereoPhoto maker by Masuji Suto. Open the two images as left/right:

On the dialog that pops up, mark the two Faerie close-up images, and click on Open:

The application window will now look like this, showing the two images side by side:

Step 9: Adjustment

Press now the “K” key on the keyboard. The Easy Adjustment window will appear:

Using the H position slider adjust the images until the two Stereo Window frames are precisely superimposed:

Press OK to return to the main window, which will look like this:
This concludes the adjustment process.

**Step 10: Cropping**

The image needs now to be cropped. Using the free crop tool we mark the image just inside the Stereo Window:

![Step 10: Cropping](image)

Clicking now on the image produces the final format:

![Step 10: Cropping](image)

The image processing is finished, and the image is ready for display.

**Step 11: Displaying the image in Anaglyph format**

Choose the Color Anaglyph display format from the Stereo menu. From the various options, choose color (red/cyan):

![Step 11: Displaying the image in Anaglyph format](image)

The anaglyph image is displayed. Now you can observe it using standard red/cyan glasses.

![Step 11: Displaying the image in Anaglyph format](image)

Pressing “Enter” and “F” you can display the image at fullscreen. If your screen is 19" with 4:3 aspect ratio, and you view the image from 60cm, you will see the Faerie face unscaled, exactly as it exists in its virtual reality.

Note that there is some difficulty in fusing the background in this image. This difficulty is caused by a variety of mechanisms. Discussion of these problems is out of the scope of this tutorial.

JPEG compression spoils seriously the quality of an anaglyph image. Therefore, anaglyphs should be saved in non-lossy formats like TIFF or BMP. If you are forced to use the JPEG compression (as in making illustrations for DAZ Studio tutorials), use always the highest quality available.

**Step 12: Photographing objects larger than the Stereo Window**

Let us scale up the Stereo Camera by 270% and set Y translate to 158. This is how the active viewport looks now from the center camera:

![Step 12: Photographing objects larger than the Stereo Window](image)

The Stereo Window rule is clearly violated by the Faerie's wing and tummy. In order to deviate as little as possible from the Z rule, we translate the Stereo Camera by the least distance along Z, just enough to expose the Stereo Window. With Z translate = 9, the active port looks as follows:

![Step 12: Photographing objects larger than the Stereo Window](image)
Letting X translate = 0 puts the Faerie's torso precisely at the center:

It is instructive to observe the scene from the side using the default camera:

The Stereo Window represents the monitor on which the image will be displayed. The Faerie's left hand protrudes through the monitor surface and will appear “floating in the air” in front of the viewer face. The Faerie's right hand is submerged far behind the monitor surface. The span between the two hands will give the image an impressive depth sensation, which is an effect often sought by stereo photographers to impress the viewers.

**Step 13: The Faerie torso anaglyph**

To make the Faerie torso anaglyph we follow precisely the same steps as in the Faerie close-up example. We leave this as an exercise for the reader. The final result is:

**Step 14: Conclusion**

You are now in possession of all knowledge that you need to unleash the full impression of your 3D scenes by displaying them stereoscopically. The author is confident that once you get used to it, you will not want to see them flat anymore.

Stereoscopic photography in virtual reality is much easier (and much more accessible) than in real world. Therefore, it is a great laboratory for learning and mastering the subtle techniques of this art.