Amateur Anaglyphs

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Introduction

As American culture steadily migrates towards high resolution digital cameras, the production of amateur anaglyphs and stereoscopic imagery has been increasing. Anaglyphs are used as an important tool for understanding and seeing relief in distant topography. With the production of anaglyphs, the unseen ZED dimension will be spatially represented. National Aeronautics and Space Administration (NASA) has a high demand for anaglyphic imagery. Without anaglyphs, the topography of other planets, including Earth's moon would be unknown. The Viking spacecraft that went to Mars during the 1970s returned many stereoscopic images and now those images are being compared to the high resolution (1.4-20 m/pixel) Mars Orbiter Camera images taken since September 1997 (Edwin Sheffner, 2000). The results are showing that the planet Mars may be exerting mass movement, but details regarding the nature of the flow and initiation mechanisms are still under study. The Pathfinder spacecraft has enabled the scientists at the Jet Propulsion Laboratory to use anaglyphic images to experience the topography of Mars in a 'realistic' setting.

The word anaglyph is derived from two Greek words, 'ana' (up) and 'glyphien' (to carve). Which translates to- 'carve up'. A further derivative of 'glyphien' is 'glif', which is defined as a grove or channel, any incised or raised figure. Today, an anaglyph is defined as a picture, still or motion, of contrasting colors (usually red and green, or red and cyan) that appears to be three dimensional when the images have been superimposed as the viewer wears the contrasting goggles. Anybody with normal vision can see 3 dimensions through an anaglyph.

In 1853, W. Rollman illustrated the anaglyph principle with a red and blue line drawing. Five years later, the Frenchman J. D'Almeida began projecting 'magic' three dimensional lantern slide shows using red & green filters as the audience was wearing colored lens goggles. In 1889 was a very studious year as William Freise-Green created the first three dimensional anaglyphic motion picture, which was shown to the public in 1893. The 1920's produced many anaglyphic products. Anaglyphic motion pictures –so called 'plasti-grams'- quickly grew in popularity. In 1922, William Van Doren Kelley premiered an interactive plasti-gram at the Rivoli Theater in New York titled "Movies of the Future". The film provided the viewer with an optional ending. When the viewer used the green filter the so called 'happy ending' was seen, but if the red filter was used, the 'tragic ending' came out. As the plasti-grams lost popularity, comic books were published in 3 dimensions during the 1950's and 'Space Goggles' were widely distributed. It was not until 1996 that the first anaglyphic map was developed. The 2nd International Airborne Remote Sensing Conference in San Francisco, California, held one of the first showings of this anaglyphic map. An anaglyphic map is also known as a 'Geowall'; as the imagery is projected onto a screen, the viewers are wearing 3D glasses (red/ cyan colored lens) and perceive elevation relief in this two dimensional image.

The purpose of this project is to present steps and procedures necessary to compose amateur anaglyphs using Adobe Photoshop 7.0. The understanding of how simple it is to construct anaglyphs will lead to further advances and developments in remote sensing.

The study area selected for this project was my home (Fig. 1) in Nixa, Missouri. This site was chosen based on several factors: close proximity, availability if necessary for returns, no financial expenditures, and multiple linear features to assist in the alignment of the superimposed images

Fig. 1

Methodology

Constructing Amateur Anaglyphs

Collect Digital Photographs
5m buffer, 1m distance, 0.2m increment

↳ Import Digital Photographs into Adobe Photoshop 7.0

↳ Adjust "Master Saturation" in all images

↳ Remove "Red channel" from the right image

↳ Remove "Green channel" and "Blue channel" from the left image

↳ Insert both images into new window (as separate layers)

↳ Adjust blending mode to "Screen" settings

↳ Move left image to match the placement of linear features

↳ Crop the new image, excluding the area with 2 images overlapping

↳ Save the new anaglyph

Using a Kodak Z740 digital camera, 38- 380mm, take a picture of the desired object. Do not adjust the zoom after the first photograph has been taken. It is recommended to take all of the photographs using the lowest or highest zoom setting to easily fix any future accidents if the zoom button is changed.

With the camera move the prescribed distance to the left or to the right, based on the camera's distance from the closest point of the desired object, take the next photograph. It is essential to keep the focus line parallel to the original photograph (Fig 2). An easy control method of maintaining parallel photographs is to use a tripod with a rod or bar attached to it and slide the camera to the prescribed separation distance.

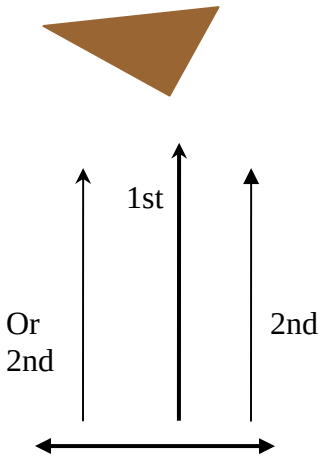

Fig. 2

Import the images into Adobe Photoshop 7.0. Previous versions of Adobe Photoshop can also be used for this project; however the prior editions may not have the all of essential features required to obtain the same results. (Please note, any feature or drop down menu in the software program that the operator needs to select will be addressed in all capitals, e.g. from the main menu bar select FILE, scroll down to SAVE AS, and in the new window type in the new NAME of the file.)

The first function using Adobe Photoshop is to change the master image saturation from 0 to 60 (Fig 2-1).

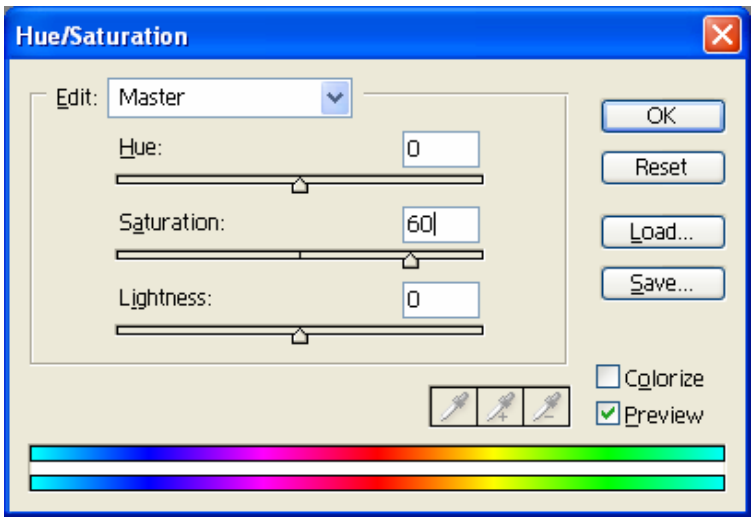

Fig. 2-1

- With the left image selected,
- Click on IMAGE,
- Move over ADJUSTMENTS,
- Scroll down to HUE / SATURATION,
- MASTER channel selected for editing,
- Change the saturation to 60
- Select OK
- Repeat these steps for the right image

This is done to prevent the anaglyph from appearing to be washed-out when viewed with the red-cyan 3D glasses.

To help facilitate the 3D effect of the red-cyan glasses, certain colors need to be subtracted from each of the images. The red color is in the left lens and the cyan color is in the right lens in which the corresponding image needs to have the opposite color. Therefore, the red channel should be subtracted from the right image and the blue and the green channels need to be removed from the left image.

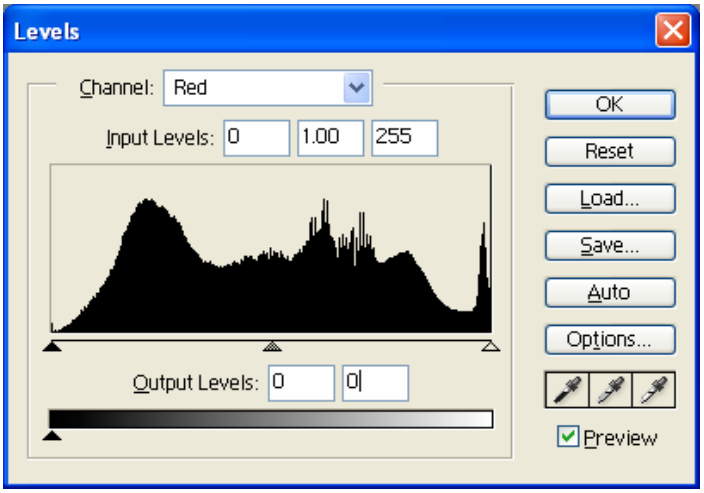

Fig. 2-2

- Select the right image,
- Click on IMAGE,
- Move over ADJUSTMENTS,
- Select LEVELS,
- 'Levels' window, select the RED channel.
- Change the output levels to 0 and 0.
- If the preview box is selected, the image will automatically change in color.
- Select OK (Fig 2-2).

Repeat these steps for the left image. Set the output levels for both the GREEN channel and BLUE channel to zero.

With the two windows open, a third window needs to be created. It will contain a copy of each image, with the red as the base and the cyan-green pasted over it.

- Activate the right image,
- Click on SELECT,
- Choose ALL,
- Click on EDIT,
- Choose COPY,
- Select FILE,
- Choose NEW, file size will default to the size of the image in the clipboard,
- Select units of PIXELS in the drop down boxes,
- Add about 200 pixels to both dimensions.
- Choose the RGB COLOR mode,
- Select TRANSPARENT for the 'Contents',
- Click OK (Fig. 2-3).

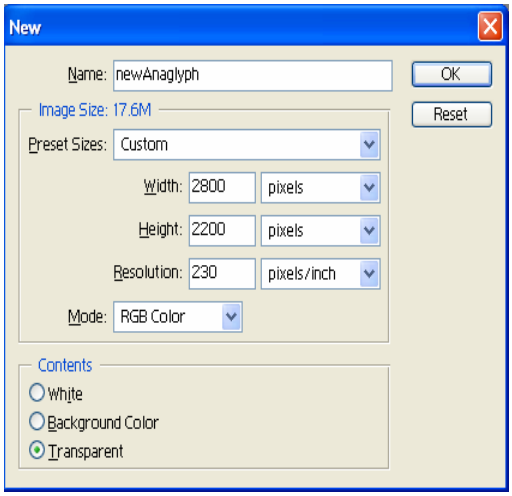

Fig. 2-3

The operator will paste the images both the right, cyan-green image and the left, red image into the new, larger window (Fig. 2-4). The new window being a little larger than the images will making it easier to align the images.

Make sure the 'new' window is activated and follow these steps:

- select the right image,
- click on SELECT,
- choose ALL,
- click on EDIT,
- pick COPY,
- select the new window,
- click on EDIT,
- choose PASTE. The right-eyed image should be centered in the larger window.

- select the left image,
- click on SELECT,
- choose ALL,
- click on EDIT,
- choose COPY,
- select the new window that has the right image copied on to it
- select EDIT,
- Choose PASTE. The left image is now on top of the right image.

Fig. 2-4

Now the ‘Layers palette’ shows two layers. ‘Layer 1’ is the right image (cyan-green). ‘Layer 2’ is the left image (red); if needed the layers can be renamed by double clicking on LAYER. At this point, the images do not appear to be ‘transparent’ as previously selected. The Blending Mode begins now.

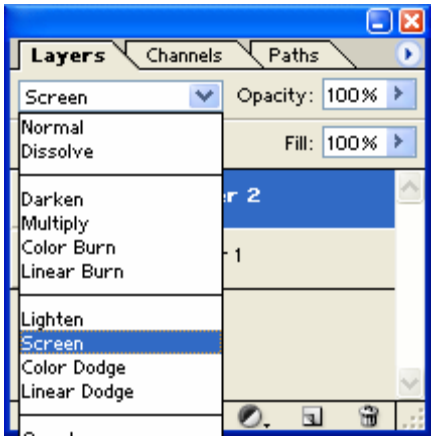

Fig. 2-5

- ‘Layers palette’, activate the top layer by clicking on its NAME.
- Change the Blending Mode from ‘Normal’ to SCREEN. (The Blending Mode appears in a drop-down combo box in the ‘Layers palette’, Fig. 2-5)
- The new window should show both images
- Move the two layers for the best effect (while viewing with your 3D glasses). The 2 images should be offset horizontally but not vertically, it is best to find and use a linear feature to base the alignment of the anaglyph.

With both of the layers imposed on each other, it necessary to move a Layer. These steps will help in the movement.

- Activate the layer by clicking on its NAME in the ‘Layers palette’,
- Select the ‘MOVE TOOL’ on the ‘Tools palette’, it’s an arrow point with a cross (Fig 2-6),
- With the Move Tool selected, there are two options of movement. The first method is to click on the image and dragging it to align the top image to the bottom image, or use the arrow keys to push or pull the top image. If the arrow keys are used, holding the SHIFT key will produce larger movements.


Fig. 2-6

The anaglyph is now ready to be extracted. To extract the anaglyph, crop the area of the image that does not have two over-lapping layers. This single layer area does not project a 3 dimensional view and it distracts from the anaglyph as seen in Figure 2-7.

- Crop the image, excluding parts where the two images do not completely overlap,
- Select the CROP tool on the 'Tools palette'; it is similar to the crop tool used for Microsoft Windows,
- Click and drag the 'Crop tool' across the image to make a cropping rectangle,
- Adjust the cropping rectangle by dragging on the little mid-edge handles,
- You can move the entire rectangle by mouse-dragging on its middle,
- Double-click on the middle of the image to finalize the cropping,
- Save the new anaglyph to complete this process.

Fig. 2-7

Results

This project tested the standards to compose an Anaglyph using a Kodak™ z740 digital camera. This digital camera can be purchased from Best Buy™ or Circuit City™. The Kodak™ camera has these capabilities: 38- 380mm, up to 5.0 megapixel resolution, different scene selection (e.g. portrait, museum, fireworks, night settings, landscape), and different color modes (e.g. black and white, high color, natural color, low color). Because of the digital zoom, there is no indication of the zoom strength; thus all pictures were collected at 38mm, equivalent to 35mm. This project utilized the 'landscape' scene, 'natural color' mode, and 5.0 megapixels (2576 x 1932 pixels) resolution settings in the Kodak™ z740 digital camera.

Pictures were collected from 5 to 15 meters away from the house in a 1 meter increment. At each meter increment, additional photos were taken on the right side with the camera separation distance being in the increments of 0.2, 0.4, 0.6, and 0.8 meters, as depicted in Figure 2.

A difficult task in this project was to maintain parallel focal points for the images. Being aware of this, I tried to take parallel photographs. It is obvious in Figure 3-1 that the focal point for the third image, 0.4m, was the same as the first image. This can be detected as the steel tape used to measure the distances away from the house is seen in both layers as it forms a vertex at the corner of the house.

Fig. 3-1

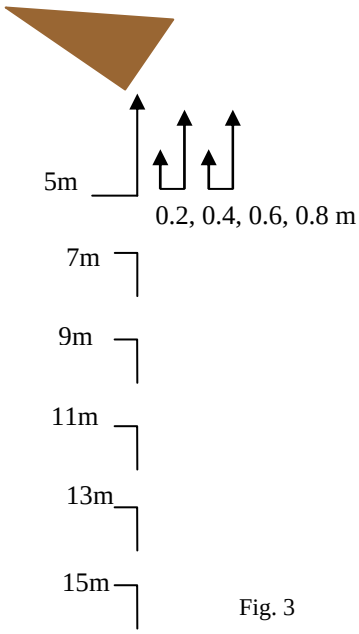

Fig. 3

One must note the recommended camera separation distance in order to obtain stereo-photographs. The Kodak™ z740 was able to develop anaglyphs with the following distances:

Distance away (meters)	Separation (meters)
5 to 9	0.2
10 to 14	0.4
15 plus	0.6

Conclusions

The camera separation distance is dependant upon the distance away from the object. A general rule of thumb can be used to determine this distance. If the object is less than 9 meters (29.52 feet) away, a shift in body weight from left to right foot or vice versa will provide a relatively accurate stereo separation. If the object is farther away, up to 15 meters (49.21 feet), a small side-step, approximately 0.6 meters (23.62 inches) will enable stereo-viewing.

The easiest method to compose anaglyphs, which is manually moving the hand-held camera, has proven the ability to produce anaglyphs. But, holding the camera by hand does not allow for truly parallel focal points. The use of an alternative picture taking method would be recommended to compensate for this error if there were several pictures to be taken. An alternative method would be to use two identical cameras, which are fixed onto a bar at the given separation distance. The bar would ideally be designed to have a sliding mount for one of the cameras so that the stereo separation can be altered quickly.

Fig. 3, 9m away 0.0x0.2m separation

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