

HOW TO MAKE YOUR OWN 3D PICTURES OF MARS



The Mars rovers *Spirit* and *Opportunity* are equipped with left and right lenses in the Front and Rear Hazard Avoidance cameras, the Navigation camera and the Panorama camera. Pairs of pictures taken from slightly different positions can be combined to produce 3D pictures known as anaglyphs, just like our human stereographic vision. All you need is a pair of red-glue 3D glasses. Instructions for making your own are on-line at stereo.gsfc.nasa.gov/classroom/glasses.shtml.

These instructions describe how to use Adobe Photoshop make your own 3D pictures of the surface of Mars, using actual images collected by *Spirit* and *Opportunity*. You can also make 3D pictures of your own subject by taking pair of pictures with a digital camera.

These instructions are modified from instructions written by Zahreh Gorjian from the Multimission Image Processing Laboratory at the Jet Propulsion Lab (JPL) that operates the Mars rovers. To learn more about 3D anaglyphs, see marsrovers.jpl.nasa.gov/spotlight/3d01.html or www.rainbowsymphony.com/3d-glasses-links.html.

Step 1

If Mars is your subject, the pictures have already been taken for you. Go to the Mars Rover website marsrovers.jpl.nasa.gov. Follow the link to All Raw Images and then pick either Spirit or Opportunity. Scan through the Front Hazcam, Rear Hazcam, Navigation Camera or Panoramic Camera for pairs of pictures. If you're not sure you've got a matching pair, check the coded image filename, 2N191979554EFFANMGP0715L0M1.JPG for example. Characters 3-11 are the timecode on the rover's clock. The 4th last character in the image name is either L or R, for the left or right lens. Select a L-picture and a R-picture with the same time. Click on the thumbnail and then the larger picture to download the highest resolution image.

If you want to create a 3D picture of your own subject, you must take a pair of pictures with your digital camera. Hold the camera steady and snap a picture. Make sure your subject stays very still, then step just a tiny bit to the right, about the distance between your eyes, and take another picture. When you slide over for the second shot, you – and most importantly your camera – should move in a parallel line.

Step 2

Open both images in Adobe Photoshop. Any photo-editing program will work as long it allows for red, blue and green color channels to be manipulated independently. It is a good idea to save the project using a different file name, so you don't destroy the original images.

Step 3

Once the left and right eye pictures are open, convert them both to grayscale by clicking on the 'Image' menu and selecting 'Mode', 'Grayscale'. Click OK to 'discard color information'. Next, assign the left eye image red, green and blue channels by going back to the 'Image' menu and selecting 'Mode', 'RGB Color' (the image will still appear gray). Do not repeat this step for the right eye image.



Step 4

Now you are ready to merge the left and right images. To begin, make sure the left eye image is still the active window in Photoshop. Open the Channels display menu by clicking on the 'Window' menu and choosing 'Channels.' Highlight the blue and green channels (press the shift key to highlight both at the same time). Important: only the blue and green channels should be shaded blue. At this stage it doesn't matter which boxes to the left of the channels show eyeballs (eyeballs indicate which channels are displayed).

Step 5

Go back to the right eye image, select the whole thing (go to 'Select' menu, then press 'All') and copy it (go to 'Edit' menu, then press 'Copy'). Switch back to the left eye image and paste (go to 'Edit' menu, then press 'Paste'). De-select the pasted image (go to 'Select' menu, then press 'Deselect'). At this point, you should see a blurred red and blue picture.

Step 6

You are almost done – all you have to do is align the images. Open the Channels menu and click on the red channel (only the red channel should be shaded blue.) The next step is crucial because it allows the red-tinted picture to be shifted over while the blue-tinted picture is still visible. An eyeball should appear in all four boxes in the channels menu, but only the red channel should be shaded blue. If only the red channel has an eyeball, click on the empty square box to the left of the RGB channel.

Step 7

To align the images, pick a point in the center of the picture to match up, a rock on the surface for example. If a person is your subject, eye pupils are a good target. Zoom in on the target by selecting the magnifying glass icon in the tool bar then click on the target until it appears fairly large. Next, select the 'move' tool located in the upper right corner of the tool bar. Left-click-and-hold on the image to slide the red-tinted image until your target matches up and no longer shows any haloes of color. If necessary, use the arrow keys to fine-tune the alignment.

Step 8

Zoom back out. Objects toward the outside of your picture should still have red and blue haloes. It is already hard enough to trick your eyes and brain into seeing 3D, so use the crop tool to remove any regions around the edges where there is only one channel.

Your creation is ready to be viewed! Put on your 3D glasses (the left eye should be tinted red) and watch the picture jump out at you from your monitor screen or a printed picture. If you're having trouble tricking your brain, first focus on the target you used to align the images. Turn your head slowly back and forth: the foreground and background objects should also shift back and forth, revealing the depth of your 3D picture of the surface of Mars!