# HOW TO DRAW OR PHOTOGRAPH STEREOSCOPIC PAIRS THAT CREATE 3D IMAGES: A detailed explanation with pictures showing how simple and easy it is to make image pairs that create three dimensional views.

(Please click **here** to visit my main page and browse 70 other topics: everything from metal detectors and knitting Nancies to the strange world of lucid dreaming.)

Lean very close to the screen, so close your nose almost touches it, and focus your eyes on the center of the drawing below. Try to make the two red dots overlap. Once they are, slowly lean back keeping the red dots overlapped. (Your eyes may feel a slight strain like they're crossing.) When you get a foot or so from the screen you should feel the image pull together and you'll be looking at a third merged image between the two real images. This third central image will have an apparent 3D depth of field so that the yellow dot looks the closest, the orange dot a little further away and so on with the black dots appearing to be the furthest. Don't worry if it takes a few tries to get it to work. Once you get the feeling of how to do it, it gets much easier.
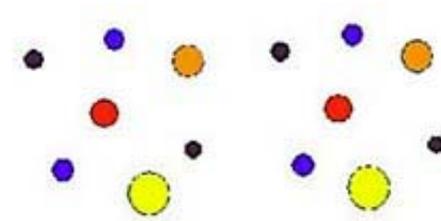


What's happening is that one of the ways the human mind figures out how far away something is by measuring the angle at which your eyes are set to focus on it. To see something that's close they have to turn in, for something further away they angle outward.

When you look at the drawing above, your eyes try to merge the two images into one. Although the two sides look the same, the yellow and orange dots on the right side have been shifted to the left. This means your eyes have to turn in to merge them with their counterparts in the left hand side and the brain interprets this as meaning that they are closer. The blue and black dots have been shifted to the right forcing your eye to turn outward to merge them thereby fooling your brain into thinking they are further away.

Sets of pictures like the one above that create 3D images are called *stereoscopic pairs* and are easy to create.

Step 1: On a piece of paper or computer screen, set up a drawing area that's 1.75 inches high and 4.25 inches wide. (The reason for this size is that if you work on an area much larger it's difficult to merge the two images and if it's smaller the side images crowd the central image too much and interfere with the effect.) Next draw a random set of dots on the left side.

Step 2: If you're on a computer, copy and paste all the dots on the left onto the right side. If you're drawing on paper, lightly trace them (they'll get darkened in after the third step.) Make sure that the horizontal positions of the dots on the left and right halves are level. Also, you want about 3/4 inch separating the two images.

Step 3: Working on the right half, decide which dots you want to appear closer and shift them 1/16 to 1/8 inch to the left. The further they are moved the closer they'll appear to be in the final 3D image. In this case the two dots on the right were moved to the left to create the illusion that they are closer. Similarly, the two dots on the left side of the right hand picture were shifted to the right to make them appear further away in the final merged image.

This is easy on a computer using select-and-drag. If you are drawing this by hand, simply draw new dots shifted the desired direction close to the original dots and then erase the original dots. Once that's done, darken in the dots. (That's the reason I recommended copying the left side onto the right lightly, so that it would be easy to erase.)

Step 4: You're done! Lean close to the image below, overlap any of the dots and pull back. You should see a 3D image with the dots separated in space.

In addition to the brain using the angles of the eyes to guess at how far away something is, it also looks for patterns to help it determine distances. One such pattern is size. In general, larger objects

are closer than smaller ones. A much weaker pattern is color: a pattern of color, as in a rainbow, can signal the brain to expect an order to objects. The picture below employs both of these tricks to strengthen the 3D effect of a sequence of dots similar to what we drew above:
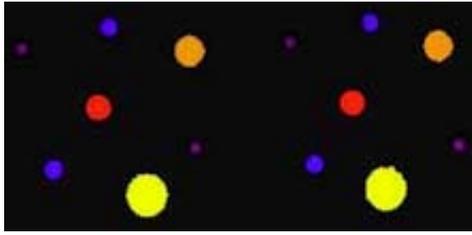


Three dimensional fields of stars are easy to create using the stereoscopic pair technique.
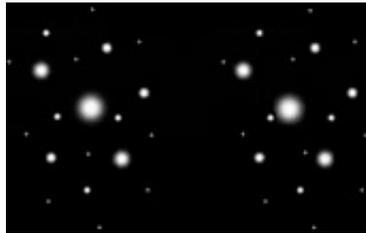


Colors make the same star field more entertaining, though perhaps not as accurate.



For people who don't mind a little more work, the 3D effect can be increased by using three dimensional spheres instead of dots.
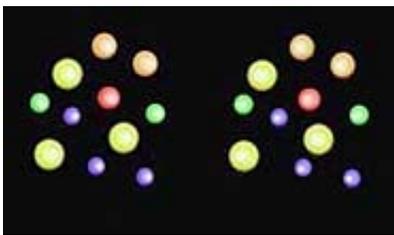


Examine the dots in the drawing above carefully and you'll notice that what makes them look spherical is that the centers are slightly lighter than the edges. This creates the edge darkening effect you get when looking at a real sphere. Look even closer and you'll see the these brighter areas lean to the right on the left hand dots and lean to the left on the right hand dots. Since the brighter areas on each pair of dots are closer than the rest of the pair of dots, that part of the dot in the merged image looks slightly closer making the dot look like it's bulging outward as if it were a sphere. Go easy on this technique and don't make the differences of the position of the light areas between right hand and left hand dots too large or instead of making the dots look like spheres the light areas will appear to be

floating above the dots. You can see this in the blue dots in the picture above.

One popular use of stereoscopic pairs is to use two pictures of a planet taken half an hour or so apart. During the time lapse the planet rotates so it's viewed from a slightly different angle. When two such images are merged by the viewer, a very realistic 3D image of the planet is created. Here are several examples:

The moon:
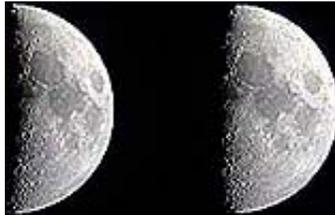


Mars:
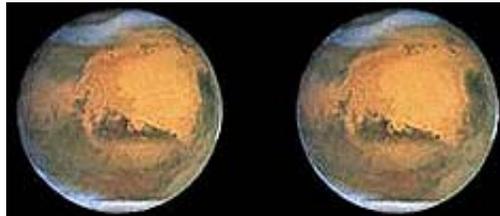


The next image of Mars looks the same, but examine the 3D-image carefully and you should see that it actually looks like the image was painted on the inside of a bowl instead of the outside of a sphere. The reason is that the image on the right should really be on the left. Half of all the astronomical stereoscopic pairs I see on the Internet have this error.
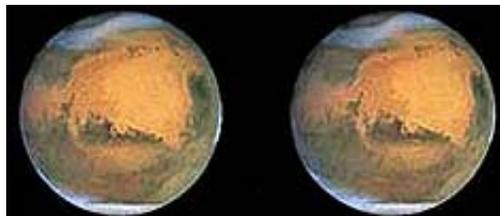


From time to time when looking at at stereoscopic image, my mind registers the opposite of what it should be seeing and convex surfaces, like a planet, will look concave, like a bowl. I'm not sure why this happens but it may explain why some people get the image order reversed.

Jupiter is my favorite stereoscopic planet.
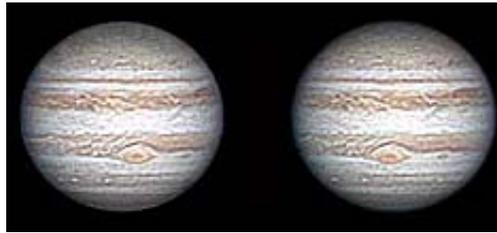
Saturn is a close second.



Astronomical objects that don't rotate or are too far away to show any angle shift over time can be massaged to create a 3D effect. In the case of the M8 nebula below, a few of the stars in the right hand side were shifted to the left to make them appear further away and the blue nebulosity and a couple of other stars were shifted to the left to make them appear closer.



To create a 3D illusion for the picture of the galaxy M81 below, many of the stars around the galaxy in the right hand image were shifted to the left to make them appear closer. This is as it should be because all the stars we see are in our galaxy and all of the galaxies are further away.



Unfortunately, some people either forget this fact and create stereoscope pairs like the one below that shows the stars further away than the galaxy.

It's easy to make stereoscopic pairs from photographs taken at home. Simply take two pictures of the same object, moving the camera 10 degrees to one side or the other between them. (For ten degrees move about two inches to the side for every foot you are away from the object being photographed.) Print them out 1.75 inches tall and wide and paste them side by side on a computer or use tape to connect them if you are using prints. Be sure to leave 3/4 inch between each image.

Here are some examples using flowers as the object. In the first picture the upper pair were taken 5 degrees apart and the lower pair ten degrees apart. The upper pair is easier to merge but the resulting 3D effect is weak. The lower pair is better. Moving more than 10 degrees creates image pairs that may be very hard, and almost painful, to merge.



Here's a larger version of the flowers to demonstrate how hard it is to merge large images.



Two tricks to help with this image pair are to lean further back and concentrate on the dark spot in the middle of the rose. Younger people are much better at merging images than older people.

Next is a toy spaceship from my days in the Cub Scouts:

Using object spacing to control how your mind interprets distance can be demonstrated on a simple typewriter. In the picture below, the spacing between the two middle rows of "Os" is close so they will appear near in the merged image. The outer two rows have larger spaces so they will appear further away. The total effect is to create a blunt wedge shape pointed at you. Leaning back two feet or more from the screen will help with this one.
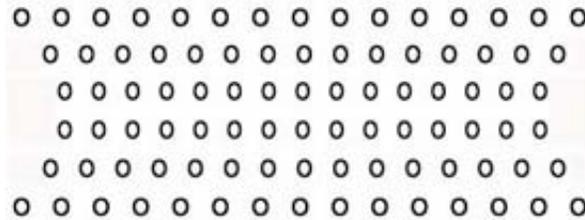


It's possible to create large 3D drawings by overlapping different fields of letters where each field has it's own spacing. Such pictures are called Hidden Image Stereograms (SIRDs.) Taken to an extreme the image at first looks like nothing more than a random collection of finely spaced dots. Then your eyes "lock" on and a three dimensional image jumps out of the page at you. (For examples of SIRDs try the URL: http://www.vision3d.com/sghidden.html.)

SIRDs use a slightly different merging technique called "parallel viewing." To create the 3D illusion you force your eyes to look past the picture. In the stereoscopic pairs you use crossed-eye viewing to merge the images. This is why getting the rows of typed "Os" above to look 3D it feels different than the stereo pairs used previously.

How can you create a stereo pair when all you have is a single drawing at one angle? The answer is simple: cheat.

Use copy-and-paste to create two side by side copies of the image. Then select the right hand image and squash it vertically. This simulates the change in angle needed to provide the 3D illusion. The effect isn't perfect but can still be impressive. Consider the stereo pair below of an illusion taken from my **Optical Illusion** page. Because the primary image is an illusion it can be difficult to focus on one area to merge. I recommend focusing on the rectangular top of the columns.



The system of using stereoscopic pairs to create 3D illusions was invented by Charles Wheatstone in 1838 and is the same as the principle used in ViewMaster scopes. The only difference is that lenses are used to make the images appear larger. (By the way, if you feel crossed-eyed using them it's because the eyepieces are spaced for young children and are too close for adults.)

If seeing the two side images bothers you, you can make them disappear by viewing the images through a pair of toilet paper rolls. Play with the position and angles and you'll find a point where you can see the central merged image with the 3D effect but not the two side pictures. (A word of caution: Do this in the privacy of your home. If you're spotted in public holding toilet paper tubes to your eyes you're going to be talked about in ways that will be detrimental to your reputation.)

There are 3D goggles with a small television screen in each side. These work in much the same way as stereo pairs. What happens is that images taken by two different cameras a fixed distance apart are alternately flashed on the left and right screens. The flashing is so fast that your mind blends the images into a seamless motion picture, just like regular TV. But, because the images in the left and right sides were taken at an angle relative to each other your mind also generates a three dimensional image of the scene.

One last point: the 3D images that look like two overlapped red and blue images and have to be viewed through red and blue goggles are called anaglyphs.

If you have any questions please feel free to **email**. I look forward to hearing from you.

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