CHAPTER 7 - THE PHENOMENON OF THREE DIMENSIONS

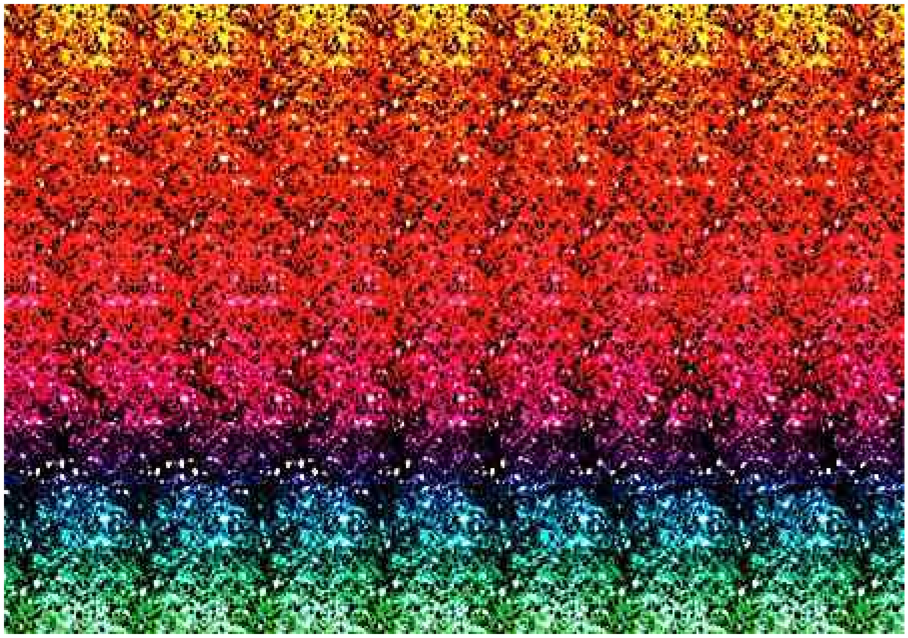
The close side-by-side positioning of our eyes allows each one to take a view of the same area from a slightly different angle. The two eye views have much in common, but each one picks up visual information the other doesn't. Have you ever compared the different views of your right and left eye? In this chapter we will create drawings that are truly three-dimensional when viewed through a stereoscope. A stereoscope is a device for viewing stereographic cards. These are cards contain two separate images printed side-by-side to create the illusion of a three-dimensional image. Since practically nobody owns one of those old-fashioned hand-held devices, we're going to have to make one of our own.

Objective:
To understand the concept of stereoscopic and create drawings that become three-dimensional when viewed through a handmade stereoscope.

Vocabulary:
Alignment
Binoculars
Converge
Depth
Diameter
Lateral Displacement
Reflection
Stereoscope
Stereoscopic
Superimposed

Materials:
Standard white paper
Several large sheets of 22 x 29-inch white poster-board (cut in half to the more manageable dimensions of 22 x 14 1/2-inches),
A ruler
Sharp No. 2 pencils
A quality compass
A pair of scissors
2, 12" paper towel rolls
Cellophane tape
An eraser
1/2-inch x 3 1/2-inch white label strips (recommended)

Remember some years ago those abstract, rhythmic images. If you stared at them long enough, you could see distinct three-dimensional images in them? See the hidden "Saturn" in the image below using techniques described on the website listed.



(From http://www.vision3d.com/sghidden.html)

If this exercise is to produce good results, accuracy is essential. We need to create two almost identical drawings, side by side, one for the left eye, and another for the right eye. Because our eyes are a short distance apart, each view is slightly different. Our two drawings must reflect that slight difference.

Steps:

1. Very carefully and as accurately as possible, use a ruler to draw two identical squares (4” x 4”) on a sheet of graph paper spaced about two inches apart. In the very center of the left square, draw a 1” block (4, ¼” intervals) with a pencil and ruler. In the right square, find the same central 1” block, but move over one ¼” block either way and draw your one-inch square. **(Figure 7.1)**

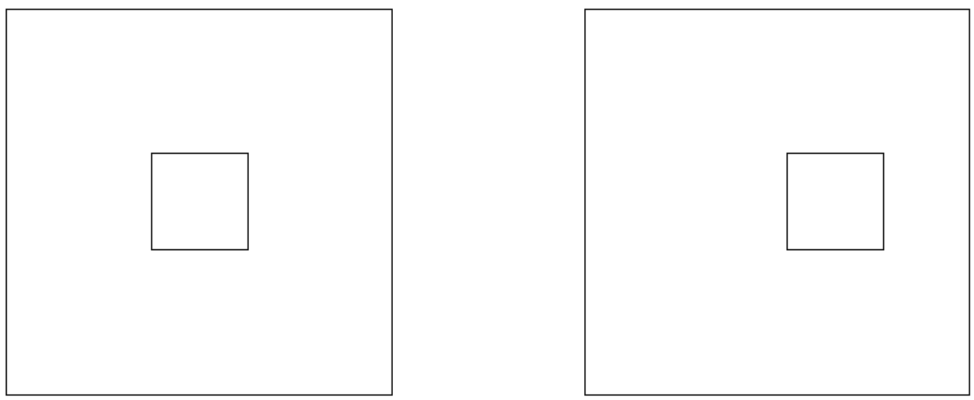


Figure 7.1

2. Next, in both squares, connect the corners of the inner blocks with the corresponding corners of the outer blocks using a ruler. **(Figure 7.2)**

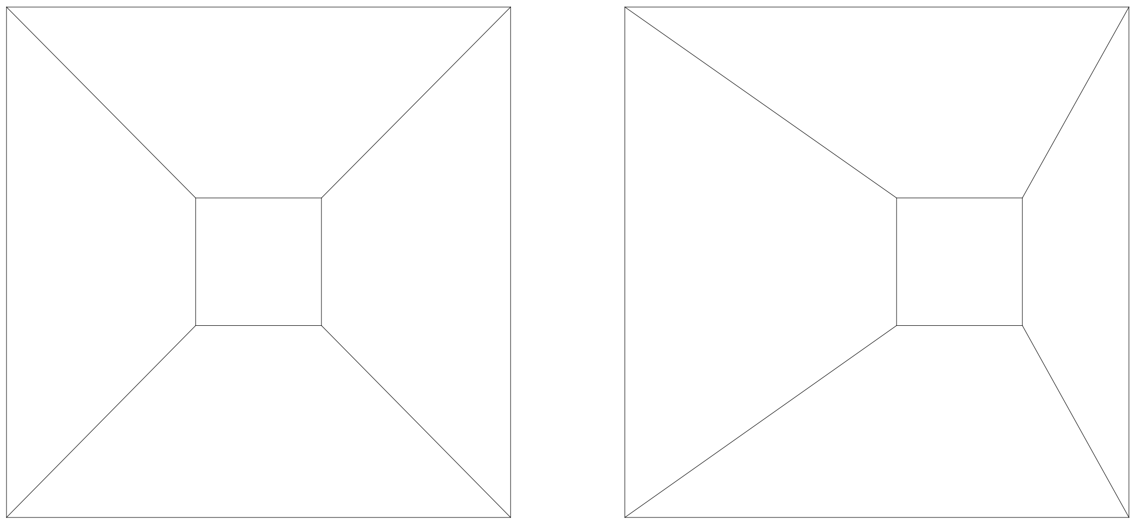


Figure 7.2

3. These two drawings are now a stereoscopic pair, one for each eye, which when seen through a stereoscope, will appear either as a flat-topped pyramid (seen from above), or a long tunnel. Now we need a stereoscope to view this phenomenon.

4. You can create a stereoscope with two cardboard tubes from rolls of paper towels, wax paper or aluminum foil. Both tubes must be 12-inches long and of the same diameter. At one end, the tubes should be joined together using a piece of tape. At the other end, space the two tubes about an inch or more apart to accommodate the space between the drawings that you just created. Your stereoscope will perform similarly to a pair of binoculars. Each eye sees a slightly different image and relies on the brain to converge the two separate images in an effort to make sense out of the scene. Your brain will help you create the 3-D image you desire. Cut a small piece of poster-board with two holes and fit it over the two tubes to hold them in place. You can also cut a larger V-shaped piece of poster-board and glue the two tubes to it in the proper configuration. This will make a more solid, long-lasting viewer. **(Figure 7.3)**

Figure 7.3

5. Position the side-by-side drawings you created on a well-lit flat surface. With the cardboard stereoscope over your eyes, the viewer should stand directly over the two drawings so that the left tube is over the left drawing, and the right tube is over the right drawing. You might have to adjust the drawings—or the tubes—a little in either direction for proper alignment. To facilitate viewing, close your eyes for a few moments while holding the tubes in place, and then open your eyes. By relaxing the eyes in this fashion, it will cause the two images to "converge" into one dramatic 3-D image.

6. Not everyone will be able to achieve this stereoscopic effect on the first try, but with two or three repeated efforts, the image usually falls into place. It might not be a bad idea to have a real, old-fashioned hand-held stereoscope on hand if you can find one, in which case the left and right images will have to be reset on a piece of poster-board cut to fit the apparatus.

7. Here are a few other 3-D designs **(Figure 7.4 and 7.5)**, all of which will work using your stereoscope. You may try to create some designs of your own, but remember to work it is important that the two images strictly obey to the rules of perspective and that for every object to be depicted 3-Dimensionally. Because the 3-D effect is caused by a horizontal shift between the left and right images, it can only occur if the drawings are created using the principles stated or the images will not converge.

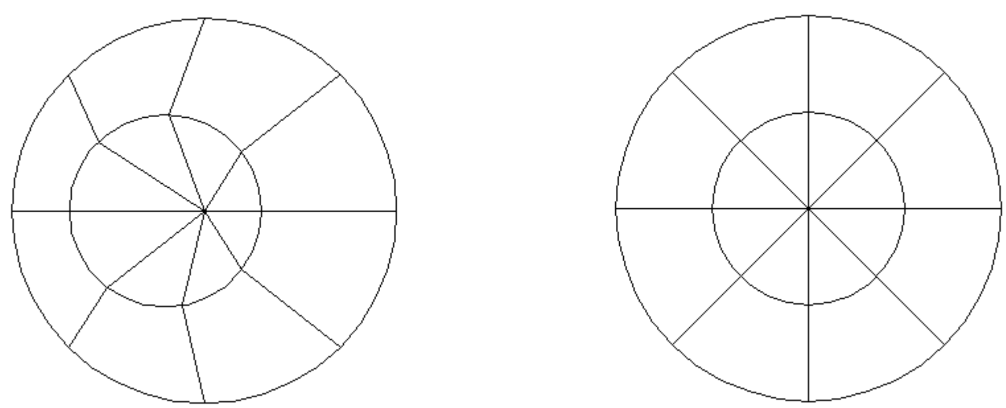


Figure 7.4

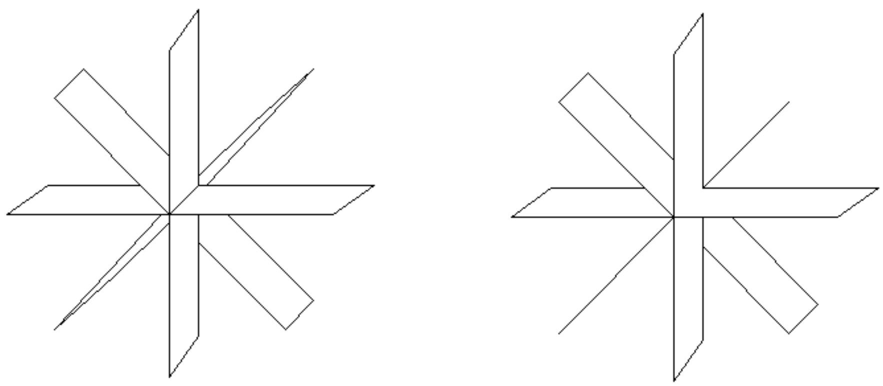


Figure 7.5

Additional Exercises:

1. The phenomenon of three-dimensional (or binocular) vision can be demonstrated in a variety of ways. For example, close one eye, and extend your arms in front of you. Try to touch the eraser-tips of two pencils. Most people will be unable to do this. Two-dimensional vision deprives us of a sense of visualizing depth.

2. Hold up a pencil about a foot in front of your nose. By bringing the pencil closer to your face, you will tend to go "cross-eyed," as your eyes converge to retain the image. While staring at the pencil, the background will appear "doubled."

3. Hold the pencil about one foot in front of your eyes, but this time look at a distant object beyond the pencil. Suddenly, there will be two pencils. Tilt your head slightly to the left then to the right, and the "two" pencils will alternatively move up and down. This simple experiment will help to explain how the lateral displacement of the eyes (about 2 inches) gives us three-dimensional vision.

4. Questions to ask: If our eyes were farther apart, would our 3-D vision be improved? Do dogs and cats have 3-D vision? Some animals have eyes on the sides of their heads--like squirrels and horses. Do they have 3-D vision? The following explanation of a horse's vision was taken from: http://www.horsewyse.com.au/howhorsessee.html.

A horse's eyes are located on either side of his head which is a big advantage for them as a prey animal as it offers a wide, circular view, meaning they can detect stalking animals sneaking up from behind. This panoramic vision is 'monocular' ('mono' meaning 'one') which enables them to view their surroundings on both sides, with either eye. Their 'binocular' vision (with both eyes) is directed down their nose and not straight ahead and the horse actually has a blind spot in front of its forehead. When a horse is grazing, his vision is directed at the ground in front of him and if he is relaxed, his monocular vision will be at work. Should he see something that warrants investigation, the horse will raise his head to bring the binocular vision into force. If the object was spotted in the horse's side vision, he will turn and raise his head, or even whole body to look.

5. Another type of viewer (guaranteed to work), is to place your two drawings about two inches apart, with a line drawn down the middle between them. On the line, stand a mirror on its edge absolutely perpendicular to the paper surface (a six- or eight-inch mirror works best). The reflecting surface may in this case be on either side. By placing your nose on the upper edge of the mirror and looking to the left or right, one eye will see the actual image, and the other eye will see a reflection of the opposite image reflected in the mirror superimposed over the first image—in perfect three dimensions!

6. There is a most unusual technique known as “free-visioning,” which allows some people with this skill to view old stereographs—and even our drawings—in three dimensions without any device whatsoever. By merely holding the paired images at arm’s length or slightly closer and allowing the eyes to relax and focus into the distance well beyond the image, the two eyes will gradually cause the two separate images to overlap into one three-dimensional picture! It’s a strange phenomenon, and not many people can do this, but give it a try. Try to view these photos below taken in Venice, Italy first using “free visioning,” then using your handmade stereoscope.

(Adapted from: http://nzphoto.tripod.com/sterea/a3dvenice.htm)