

1. What was the specific goal or purpose of this article. In your opinion, did the author achieve this goal?

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2. If you had the opportunity to make a 3-D movie, which of the two popular methods described would you use, and why?

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3. In the sentence, *The basic brain mechanisms are present from birth in the visual cortex, but only experience leads to binocular interpretation becoming "hardwired"*, what does the word *hardwired* mean?

- a. useful
- b. permanent
- c. positively charged
- d. visual

4. When using the Photo 3-D digital camera, why is it important for the subject to be still?

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# How 3-D Glasses Work

*adapted from an article by Marshall Brain*



Although the 1950s are most often considered the 3-D movie decade, the first feature length 3-D film, "The Power of Love," was made in 1922. Since that time the use of 3-D technology in theaters and on television has drifted in and out of mainstream popularity. But, whether you've used them for the big screen or at home in front of your television, you have to admit 3-D glasses are incredibly cool.

They make the movie or television show you're watching look like a 3-D scene that's happening right in front of you. With objects flying off the screen and careening in your direction, and creepy characters reaching out to grab you, wearing 3-D glasses makes you feel like you're a part of the action - not just someone sitting there watching a movie. Considering they have such high entertainment value, you'll be surprised at how amazingly simple 3-D glasses are.

In this article, we'll take a look at the two most popular types of 3-D glasses in use today. But first, let's take a look at something called binocular vision.

## Binocular Vision

Most human beings come equipped with two eyes and an absolutely amazing binocular vision system. For objects up to about 20 feet away, the binocular vision system lets us easily tell with good accuracy how far away an object is. For example, if there are multiple objects in our field of view, we can automatically tell which ones are farther and which are nearer, and how far away they are. If you look at the world with one eye closed, you can still perceive distance, but your accuracy decreases and you have to rely on visual cues, which is slower.

To see how much of a difference the binocular vision system makes, have a friend throw you a ball and try to catch it while keeping one eye closed. Also try it in a fairly dark room or at night, where the difference is even more noticeable. It is much harder to catch a ball with only one eye open than with two eyes open.

The binocular vision system relies on the fact that our two eyes are spaced about 2 inches (5 centimeters) apart. Therefore, each eye sees the world from a slightly different perspective, and the binocular vision system in your brain uses the difference to calculate distance. Your brain has the ability to correlate the images it sees in its two eyes even though they are slightly different.

A 3-D perception of the world is built up in the brain, which computes the retinal differences and interprets them as 3-D. People looking at a stereoscopic picture may find the third dimension only develops slowly. The longer they look, the more computation the brain gets through and the 3-D impression gets better with time. Those who look at many 3-D pictures seem to handle the computations increasingly rapidly, so stereoscopic vision is partly a learned response. In fact, all visual interpretation is learned in infancy, especially binocular interpretation. The basic brain mechanisms are present from birth in the visual cortex, but only experience leads to binocular interpretation becoming "hardwired". If one eye has poor muscles ("cross eyes") it is suppressed and binocular cues may never be worked out properly, which means a squint must be treated early in childhood.

If you hold a pencil in front of your nose and look into the distance, you see two pencils. Some people do not see two pencils because their brains suppress information from one eye. The suppressed eye may shift from right to left, or there may be permanent suppression of one eye. These people may have difficulty seeing 3-D pictures. People with only one eye, or with one eye suppressed, never will see in 3-D.

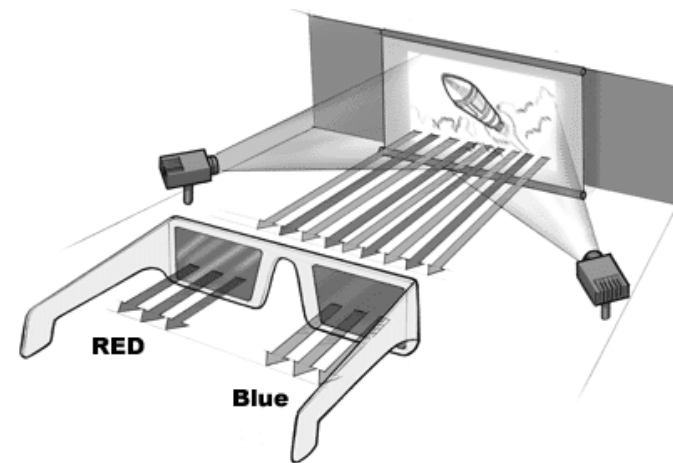


### 3-D Viewing

In a movie theater, the reason why you wear 3-D glasses is to feed different images into your eyes just like a View-Master does. The screen actually displays two images, and the glasses cause one of the images to enter one eye and the other to enter the other eye. There are two common systems for doing this:

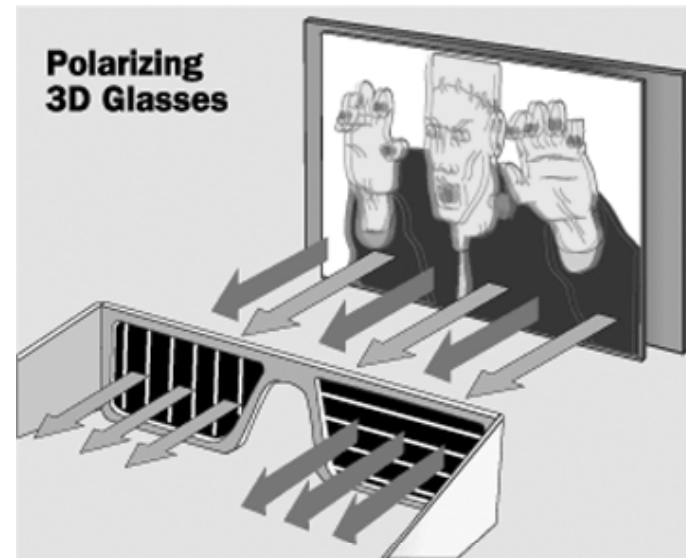
### Red/Green or Red/Blue System

Although the red/green or red/blue system is now mainly used for television 3-D effects, and was used in many older 3-D movies. In this system, two images are displayed on the screen, one in red and the other in blue (or green). The filters on the glasses allow only one image to enter each eye, and your brain does the rest. You cannot really have a color movie when you are using color to provide the separation, so the image quality is not nearly as good as with the polarized system.



### Polarization System

At Disney World, Universal Studios and other 3-D venues, the preferred method uses polarized lenses because they allow color viewing. Two synchronized projectors project two respective views onto the screen, each with a different polarization. The glasses allow only one of the images into each eye because they contain lenses with different polarization.



*The polarized glasses allow only one of the images into each eye because each lens has a different polarization.*

### Other 3-D systems

There are some more complicated systems as well, but because they are expensive they are not as widely used. For example, in one system, a TV screen displays the two images alternating one right after the other. Special LCD glasses block the view of one eye and then the other in rapid succession. This system allows color viewing on a normal TV, but requires you to buy special equipment.

### Making your own digital 3-D pictures.

Taking advantage of the popularity of 3-D movies, a number of companies have developed products that bring 3-D capabilities to consumers. Here is what one company, **Photo 3-D**, has to say about their product.

*If you already know how to use a digital camera, Photo 3-D takes just minutes to learn. Here's how it works...*

*It's surprisingly simple! The Photo 3-D attachment and software makes 3-D photography so simple, we guarantee you will be able to do it.*



*Shown here is a typical digital camera mounted to the Photo 3-D attachment and hand-held mini-tripod.*

### It's as easy as 1, 2, 3-D!

To create a 3-D photo, you need two images, one for each eye. Simply attach the Photo 3-D device to your camera (using the standard tripod socket on the bottom), then focus on your still life subject or ask your subject to stand still. Now level the camera, snap a left-eye image, then quickly slide the camera to the right position and snap your right-eye image. Now you have the accurate "stereo pair" of images necessary to create one 3-D photograph using our Photo 3-D Mixer software. Just load, mix and focus to create your 3-D photo!

### Special software does the magic!

The Photo 3-D Mixer software is designed to be very easy to use. The simple interface shows a pair of 3-D glasses, and you just click the red lens to load the right-eye image, and the blue lens to load the left-eye image. The software automatically mixes the two together, then you simply set the focus point, and voila! You've created a life-like 3-D image within just minutes. Plus, you get to keep your two regular digital photos as well as your new 3-D photo!

### Wow! Cool! How did you do that?

3-D photos are just like regular digital photos. You can print them, save them, E-mail them - the only difference is that, like watching a 3-D movie, to see the 3-D effects you have to wear the 3-D glasses.

You can mix your 3-D photos in color or black & white, and our software allows you to adjust the focal point to make your subjects appear to pop-out of or go into the photo. You can print 3-D photographs to your desktop photo or inkjet printer, or even save them to CD or your camera disk and print them at your local photo kiosk or E-mail them to a photo processor.

### Everything you need is included!

The Photo 3-D Kit includes the camera attachment, software, and several pairs of 3-D glasses, everything you need to take, see and share your own amazing 3-D photographs using your digital camera, home computer, and inkjet or photo printer.



*Additional 3-D glass in many styles are available from Photo 3-D*