

**SOMANY INSTITUTE OF  
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PRINTING  
TECHNOLOGY  
GRAPHIC DESIGN  
UNIT-4**

## What is 3D?

3D means *three-dimensional*, i.e. something that has *width*, *height* and *depth (length)*. Our physical environment is three-dimensional and we move around in 3D every day.

Humans are able to perceive the spatial relationship between objects just by looking at them because we have *3D perception*, also known as *depth perception*. As we look around, the retina in each eye forms a two-dimensional image of our surroundings and our brain processes these two images into a 3D visual experience.

However it's important to note that having vision in both eyes (*stereoscopic* or *binocular vision*) is not the only way to see in 3D. People who can only see with one eye (*monocular vision*) can still perceive the world in 3D, and may even be unaware that they are [stereo blind](#). They are simply missing one of the tools to see in 3D, so they rely on others without thinking about it.

Here are some of the tools humans use for depth perception:

- **Stereoscopic vision:** Two eyes provide slightly separate images; closer objects appear more separated than distant ones.
- **Accommodation:** As you focus on a close or distant object, the lenses in your eyes physically change shape, providing a clue as to how far away the object is.
- **Parallax:** As your head moves from side to side, closer objects appear to move more than distant ones.
- **Size familiarity:** If you know the approximate size of an object, you can tell approximately how far away it is based on how big it looks. Similarly, if you know that two objects are a similar size to each other but one appears larger than the other, you will assume the larger object is closer.
- **Aerial perspective:** Because light is scattered randomly by air, distant objects appear to have less contrast than nearby objects. Distant objects also appear less color-saturated and have a slight color tinge similar to the background (usually blue).

In order to represent the 3D world on a flat (2D) surface such as a display screen, it's desirable to simulate as many of these perception tools as possible. Although there is currently no way to simulate all of them at the same time, video does use a combination. For example, aerial perspective and size familiarity are automatically captured by the video camera. In CGI scenes, aerial perspective must be added so that distant objects appear less clearly (this is called *distance fog*).

Of course the addition of stereoscopic images (a separate image for each eye) is a significant improvement—so much so that most people think of stereoscopic films as being 3D, and all others as being 2D.

## 2D Film & Video

A traditional 2-D video image has width and height but technically it has no depth, i.e. everything in the image is presented at the same distance from the viewer. Still, the viewer *does* perceive the image as three-dimensional by subconsciously using the techniques listed above—much the same as how stereo-blind people perceive the real world.

## 3D Film & Video

3D video adds stereoscopic vision, meaning that two separate images are shown simultaneously—one to each eye. This presents enormous technical problems which is why there is still no perfect system almost 100 years since the first 3D movie was made.

Common display methods include:

- **Anaglyphic processing** (red/cyan glasses): The original 3D system, now largely out of favor.
- **Polarized light system** (polarized filter glasses): The most common new system for cinemas.
- **Active shutter system** (LCD shutter glasses): The most likely standard for the first generation of 3D televisions and other displays.

Perspective is what gives a three-dimensional feeling to a flat image such as a drawing or a painting. In art, it is a system of representing the way that objects appear to get smaller and closer together the farther away they are from the viewer.

Perspective is key to almost any drawing or sketch as well as many paintings. It is one of the fundamentals that you need to understand in order to create realistic and believable scenes.

Artists known for their use of perspective include Masaccio, a Renaissance painter who developed a realistic style by being among the first to apply the rules of perspective; Johannes Vermeer, a Dutch artist whose carefully lighted interiors often make clever use of perspective; and Gustave Caillebotte, whose "Paris Street, Rainy Day" is a powerful demonstration of two-point perspective.

#### **Key Takeaways: Perspective**

- Perspective is used to represent the ways objects appear smaller as they move farther into the distance. It adds depth and dimension to flat images.
- In art, there are three types of perspective: one-point, two-point, and three-point.
- Mathematical perspective in art was developed during the Italian Renaissance during the 1400s.

## What Does Perspective Look Like?



Imagine driving along a very straight open road on a grassy plain. The road, the fences, and the power-poles all diminish toward a single point far ahead of you. That's single-point perspective.

Single- or one-point perspective is the simplest method of making objects look three-dimensional. It is often used for interior views or trompe l'oeil (fool the eye) effects. Objects must be placed so that the front sides are parallel to the picture plane, with the side edges receding toward a single point.

A perfect example is Da Vinci's "Adoration of the Magi." The building in the background faces the viewer, and the stairs and the side walls get smaller as they move toward a single point in the center of the painting.

## Linear Perspective



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When we talk about perspective drawing, we usually mean linear perspective. Linear perspective is a geometric method of representing the apparent diminishment of scale as the distance between an object and the viewer increases. Each set of horizontal lines has its own vanishing point. For simplicity, artists usually focus on correctly rendering one, two, or three vanishing points.

The invention of linear perspective in art is generally attributed to the Florentine architect Brunelleschi. His ideas continued to be developed and used by Renaissance artists, notably Piero Della Francesca and Andrea Mantegna. The first book to include a treatise on perspective, "On Painting," was published by Leon Battista Alberti in 1436.

## One-Point Perspective



DrGarcia/Flickr

In one-point perspective, the vertical lines that run across the field of view remain parallel, as their vanishing points are at "infinity." The horizontal lines, however, which are perpendicular to the viewer, vanish toward a single point at the center of the image.

If you are experimenting with perspective, you can practice one-point perspective by doing this:

- Draw a straight line across the middle of your drawing. This is your horizon line. Locate a point along this line—it may be in the center, though it does not have to be—and mark it. This is your vanishing point.
- Draw the facade of a simple building to the right of the vanishing point.
- Using a ruler, draw a soft line from the top-left corner of the building to the vanishing point. Then draw another line from the bottom-left corner to the vanishing point. These lines show how the building will get smaller as it gets farther away from the viewer.
- Locate the end of the building somewhere along the lines you have just sketched. Mark it by drawing a line parallel to the building's facade. Erase the remaining line segments that connect to the vanishing point.
- Using the same method, add other buildings to the drawing.

## Two-Point Perspective



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In two-point perspective, the viewer is positioned so that the objects in the drawing or painting are viewed from one corner. This creates two sets of horizontals which diminish toward vanishing points at the outer edges of the picture plane, leaving only verticals perpendicular.

It is slightly more complex, as both the front and back edges and the side edges of an object must diminish toward vanishing points. Two-point perspective is often used when drawing buildings in landscapes.

Two-point perspective uses the same method described above. The main difference is that the viewer is looking from one corner rather than head-on. For this reason, you cannot begin the drawing with the building's facade. You must first draw the line that forms the corner of the building, then use one of the vanishing points to complete the facade.

# Three-Point Perspective



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In three-point perspective, the viewer is looking up or down so that the verticals also converge on a vanishing point at the top or bottom of the image. This is the most complex form of perspective. Unlike in one-point and two-point perspective, none of the lines in the drawing are perpendicular to the viewer. Instead, each one is drawn in the direction of a certain vanishing point. If you were drawing a building using three-point perspective, you would need to begin with only a single point located on the building, then use the vanishing points to define each side of the structure.