Basic principles of drawing perspective.

Deconstructing Drawing Perspective from Photography

The three photos below demonstrate the difference between 1-Point Perspective, 2-Point Perspective and 3-Point Perspective. The first photograph (Fig. 1) is an example of one-point perspective, where all of the major vanishing points for the buildings in the foreground of Fig. 1 converge at one central location (1 point) on the horizon line. The angle of view or Point Of View (POV) in Fig. 1 is referred to as Normal View perspective. In Fig. 2, the vanishing points for the two opposing faces of the center foreground building project towards two different vanishing points on the left and right sides of the horizon line. In Fig. 3 we see that the horizontal building elements project to the left and right horizon and the vertical building elements project to a central vanishing point in the sky. This upper vanishing point is called the zenith, or “highest point.” If one were looking down on the object from a Bird’s Eye perspective, the vanishing point below the horizon and would be called the nadir, or “lowest point.”

In the next three diagrams, you will see the same three photographs with Vanishing Point trajectory lines (magenta) and Horizon Lines (blue) traced over the subject matter. Fig. 4 and Fig. 5 are both examples of Normal View perspective. A Normal View angle places the Horizon Line at a natural height as if the viewer was looking straight forward without tilting the head/camera up or down. In these two examples, you will notice that all of the vertical features of the buildings are straight up and down.

In Fig. 6 (below, right) you see an example of a "worm's eye" perspective, where the head/eyes or camera is tilted upward placing the horizon below the picture plane. This is the opposite of a "bird's eye" perspective where the viewer is looking down on the scene. In a worm's eye perspective view where the viewer's eyes or camera is tilted in an upward direction, this creates a third vanishing point at the zenith. All of the vertical building features will converge at this upper vanishing point. If we were looking down on a subject in a bird's eye view the vertical details would converge at the nadir.
This technique of tracing parallel lines to their convergence point would be used to construct a Perspective Grid from exiting photographic material. Each convergence point will represent the exact location of the Horizon line, Zenith, or Nadir in that photograph, and this information can then be used to extrapolate the correct perspective for any new additions to the photo. Of course, this assumes that any new addition has vertical and horizontal lines which are parallel and/or perpendicular to those in the existing photo.

The Illusion of Depth

In the preceding photographic examples you will notice that as an object recedes towards a Vanishing Point (infinity) it appears to get smaller. This phenomenon is due to the fact that the "viewer" is at a steeper angle of view when looking an object that is in close proximity as opposed to an object of the same size that is farther away and therefore, viewed at a shallower angle. This phenomenon was first observed during the 16th century, when a German painter and printmaker named Albrecht Dürer began drawing observed objects onto a sheet of glass (below, left), later known as the 'picture plane.' Prior to the discovery of the picture-plane, artists used their best guess to determine perspective (below, right).

The picture-plane shown in the diagram below represents the point where the observer perceives perspective. In the physical world, the "picture plane" (as shown below) represents the point at which the observer perceives perspective as interpreted by the lens of the eye. In the world of illustration, the "picture plane" is actually the flat surface of the paper or computer screen, and the perception of 3 dimensional depth or perspective is an artificial illusion.
Drawing in Perspective

The following diagram Fig. 7 is a sample of the typical reference material you might expect to receive on a technical illustration project. All of the major plan and elevation views are represented here as well as an Isometric view. From this reference, we will construct a variety of perspective views in the tutorials that follow this page.

**Fig 7**

In the following six examples, you will see a perspective grid and our subject in various aspects discussed in the previous paragraph. Fig. 8 is a Normal View 1 Point Perspective drawing. Fig. 9 is a Worm’s Eye View 1 Point Perspective drawing. Fig. 10 is a Bird’s Eye 1 Point Perspective drawing. Fig. 11 is a Bird’s Eye or High 3/4 View 2 Point Perspective drawing. Fig. 12 is a Bird’s Eye 3 Point Perspective drawing. If you were to extend the vertical vanishing point lines downward, they would converge at the Nadir Station point.
2 Point vs 3 Point Perspective

Perspective vs Isometric Drawing

By now you may have noticed that perspective drawing techniques differ from other types of commonly seen technical imagery. In Fig. 13 you have three examples of 3/4 view illustrations that are not in perspective view. They are classified as Isometric, Dimetric, and Trimetric drawings. In these types of illustrations all parallel lines remain parallel and therefore, never converge at a single point. Although they can be very useful for conveying technical information, they lack the quality of realism when compared to the perspective view drawing example in Fig. 14.
In this step-by-step lesson we are going to create a simple "2 Point Perspective" view drawing of our test subject example, working from both plan (overhead) and elevation view (side view or profile) reference Fig 1. This type of illustration angle is referred to as a "3/4 Perspective" or an "Angular Perspective" view. The green dots in all of the following perspective grid diagrams identify the lines to be drawn as shown in each visual example. This type of perspective grid is best done using vector drawing software such as Adobe Illustrator, where you can easily drag a single anchor-point on each line drawn, rotating it from the other fixed anchor-point to create a "projection line" from the fixed point.

The first line to draw will be the horizontal Picture Plane line shown in Fig. 2. By placing the vertical line (green dot) off-center (to the right) between the two vanishing points we will ultimately see more of the left side of the subject than the right side. Typically, you want about the same amount showing on both the left and right side of the object if it is roughly square (like a laser printer), and a little more showing on the long side of a rectangular object such as a car or ship.

We will place the lower right corner of our Plan View diagram on the horizontal Picture Plane line and rotate it clockwise Fig. 3 while keeping it in contact with the picture plane. The choice of a 30 degree angle for our plan-view diagram is totally arbitrary, but this positioning provides a good final angle for a typical 3/4 view drawing. The ultimate angle chosen, and the wide-angle or narrow (telephoto) angle of view should balance factors such as the best aesthetics for the subject matter being illustrated, and the necessary technical information (highlighted features) to be conveyed. The subject always dictates the best observing angle chosen. In
In Fig. 4 we will locate the Station Point which will be located directly below to leading edge (lower corner) of the diagonal plan-view. Measure the horizontal width of our Plan View (X) and double it. Extend a vertical line from the corner that touches the Picture Plane downward. At two times “X” we will locate the Station Point.

Draw lines for the Horizon and Ground Line Fig. 5. The location of these lines are infinitely variable, but their location will ultimately determine how high or low the viewer is in relation to the subject. The location of the Ground Line in relation to the Horizon Line will determine how far above or below “eye level” the object will be viewed. The lower the ground line, the higher the viewer is in relation to the subject.

If the ground line was located directly on top of the horizon line the viewer (or camera) would literally be at ground level. The location of the Horizon Line will depend on whether you want to view the object from above eye-level or below eye-level.
Draw 2 lines from the Station Point (SP) that are parallel to the bottom edges of the Plan View Fig 6. The lines should intersect with the Picture Plane (points a & b). Next draw vertical lines from points a & b to the Horizon Line. The point where these vertical lines intersect the Horizon Line is where the left and right vanishing points (LVP & RVP) will be located. The location of the vanishing points will determine how severe the perspective is. The further away they are in relation to the subject, the more "telephoto" the view will be. If the vanishing points are closer to the subject the view will be more like a wide-angle lens.

The last part of our preliminary layout will be to place the Side Elevation view from Fig. 1 onto the Ground Line, with the furthest left edge aligning with the left vanishing point. Project a horizontal line (orange dashed line b) from the top of the Elevation View to the vertical Line of Sight (LS) Fig. 7, below.
We are now ready to start projecting our blue lines to and from the left and right (LVP & RVP) vanishing points. Referring to **Fig. 8**, draw lines from both vanishing points to the top (uppermost surface) and bottom (lowest, ground level surface) reference points of our subject (points a & b).

To locate each of the vertical lines on our subject, draw lines upward beginning at the Station Point and intersecting with the left and right corners (a & b) on the plan view diagram **Fig. 9**. At the point where these vertical lines intersect the Picture Plane (c & d), draw vertical lines downward (orange dashed lines) to intersect with the left and right vanishing point’s blue projection lines (green dots).
Using the same procedure as shown in Fig. 9, start constructing all of the smaller features on the subject as shown in both the Plan View and the Elevation View (a & c) in Fig. 10. Once located, project these horizontally towards the left and right vanishing points using our blue projection lines. Then connect each parallel and/or perpendicular intersecting point with a vertical line to complete the vertical shape. Continue repeating this process through Fig. 11 until all vertical and horizontal surfaces have been completed.
The last step is to darken the object's construction lines, remove all of the blue projection lines, and add weight ("stroke weight" in Adobe Illustrator) to all of the exterior and outside edge lines of the object, to increase the readability and visual appeal of the drawing Fig. 12.