Peter Clements Art Studios

How to Draw Axonometric Illustrations

Axonometric Illustrations are used for a number of purposes. But probably the biggest being the world of computer games, graphic illustrations and other comic book type publications.

To follow-up on my previous page on How to Draw Axonometric Projections I have created this page to give you some ideas on how the axonometric projections can be used in computer graphics and similar applications.

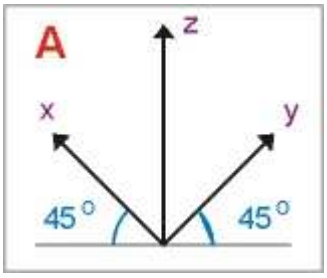
Endemic to 3D images is a sense of depth or perspective. This gives the viewer an impression of what is near and what is far or what is in front and what is behind. An aspect that is critical to 3D.

At one end of the scale are the typical component assembly type Axonometric Illustrations. Where an axonometric projection is used as a 3D illustration that indexes the different parts of a mechanical or electrical sub-assembly. However, the purposes of these types of illustrations are not quite what we are after.

The problem when illustrating a sequence of 3D 'shots' of a common scene is that the dimensions of that scene are continually changing. In true perspective all lines are related to a VP (vanishing point) and the relation to the VP's will be different from one shot to the next. Consequently, it becomes quite a job to keep track of how much the VP's change each and every line you have drawn.

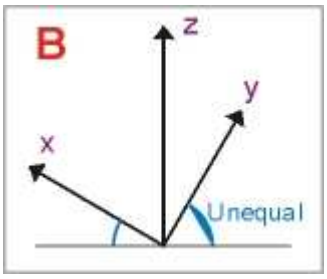
Instead of perspectives the axonometric projection is a practical alternative. Axonometric Illustrations is not true perspective but is an effective method to create an artificial sense depth in 3D. Where the same object can be made to look as though it is seen from a different position. Yet the dimensions of that object will remain constant.

Types

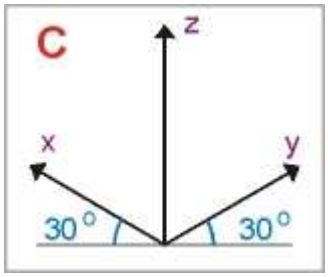


So let's recap on the different types of axonometric projections. Thereafter, I will discuss how they can be adapted and used in a 3D illustration.

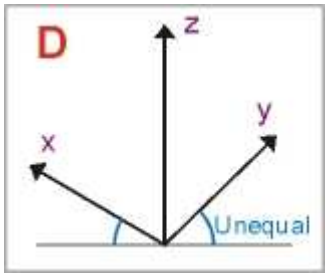
A: Is the Orthogonal Isometric projection where the x & y axis are set at 45 degrees to the picture plane. As a result the x & y axis are orthogonal to each other (or at 90 degrees). In illustrations this can be best described as a Centered Orthogonal Projection.



B: Is the Orthogonal Isometric projection where the x & y axis are set at any angle to the picture plane yet are orthogonal to each other (or at 90 degrees). Known as a Rotated Orthogonal Projection.

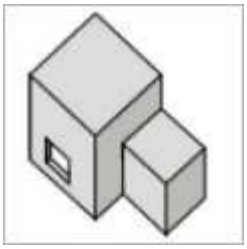


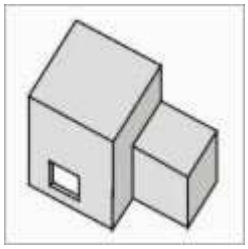
C: Is a Dimetric projection where both the x & y axis is set-up at less or greater than 45 degrees and are the same angle to the picture plane. As a result the x & y axis is not orthogonal to each other. Known as a Centered Dimetric Projection.

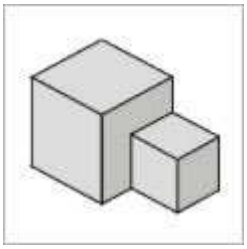


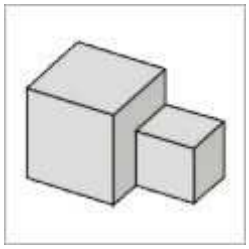
D: Is also a Dimetric projection where both the x & y axis is set-up at a different angle to the picture plane and are not orthogonal to each other. Known as a Rotated Dimetric Projection.

If we look at the images of these 4 basic types of axonometric projections we can get a hint of how they could adapted to 'fit into' 3D Axonometric Illustrations.


A: Orthogonal.


B: Rotated Ortho.


C: Dimetric.


D: Rotated Dimetric.

The first impression we get is that images A & B appear to be viewed from a higher altitude than images C & D. Next, each image from A to D appears to be rotated respectively at little more anti-clockwise.

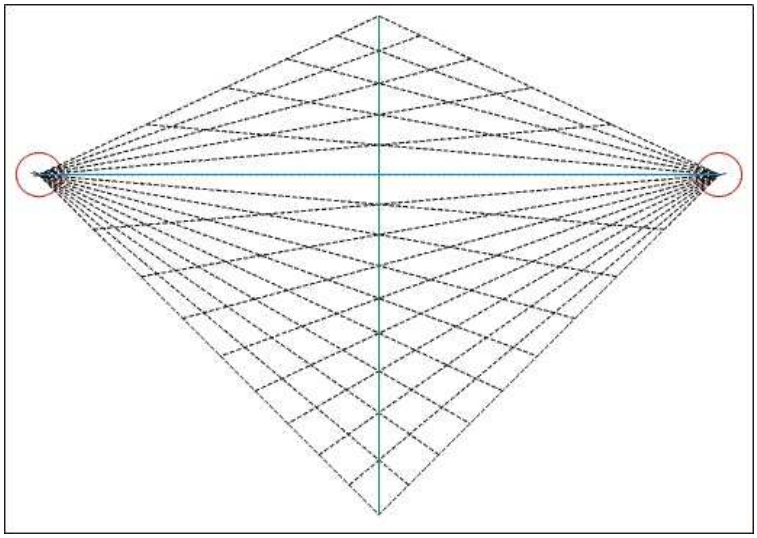
Axonometric Grid

So, where on a 3D grid do each of these images fit? Furthermore, how can we setup an image of a common object at a particular position on a 3D grid? Because an object could be seen from different positions it will have slight variations, but it's basic dimensions in Axonometric Illustrations will be the same.

Firstly, we need to copy two basic laws from 'how to set-up perspectives'.

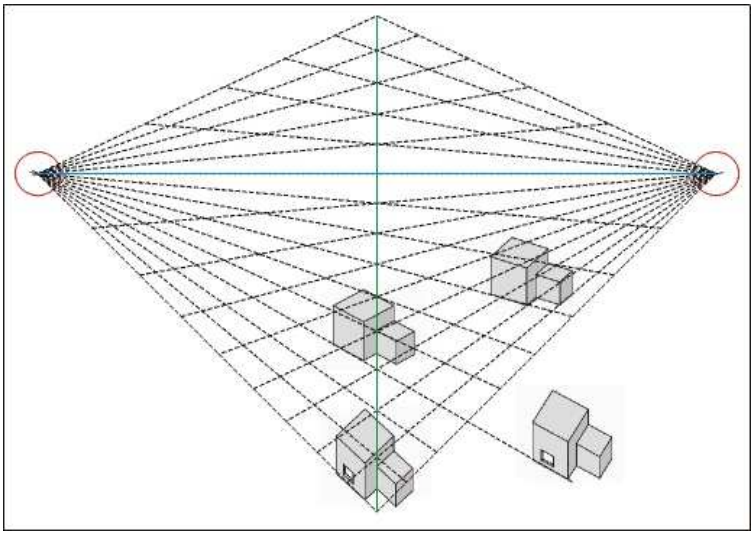
- The horizon is always at eye level and on the z-axis is at zero. As with the above examples we appear to be looking down on them. Consequently, the horizon is somewhere above them.
- To position the object we will be referring 2 vanishing points that are also on the horizon. These VP's are purely used as orientation, not setting out.

So lets see how to setup that 3D grid**.** In the example below the blue line represents the Horizon and the green line is the Line of vision. On the horizon and equidistant from the line of vision are the 2 Vanishing Points (VP's). From the 2 VP's a grid of 5 degrees was set-up.



3D Axonometric Grid

Thereafter, the 4 objects have been added at their approximate position on the grid. I say approximate because in Axonometric Illustrations this is where you, the designer can start introducing what is called 'Artistic License'. For example, here each object had been sited with the floor line lining up with the appropriate grid. But there is no reason why you could have set it up on the roofline, or even on a midway line. However, it would be advisable to use a prominent point of reference or a common vector for the setting out.



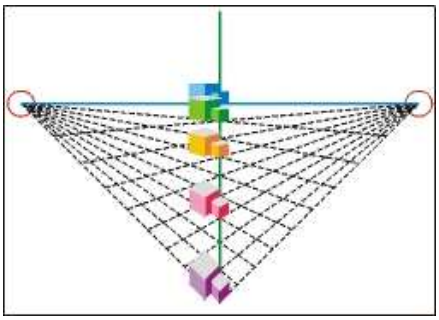
3D Axonometric Grid & Sited Objects

Furthermore, in this case all the objects are sited on flat plane and the z-axis (vertical) has not come into play. But the need to position the some objects higher or lower than its neighbour will come into play at some stage. But to do that you have to consider scale.

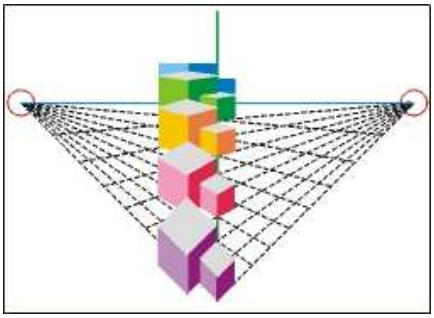
Scale

In Axonometric Illustrations scale is important to the object, but relative to the grid. Unlike perspective the axonometric projection is drawn to scale. The primary link the object has with the grid is it's setting out point to determine the

appropriate angles to set out the x & y-axis. Thereafter the object is drawn from real dimensions, and if need be move it up or down by the required z dimension.

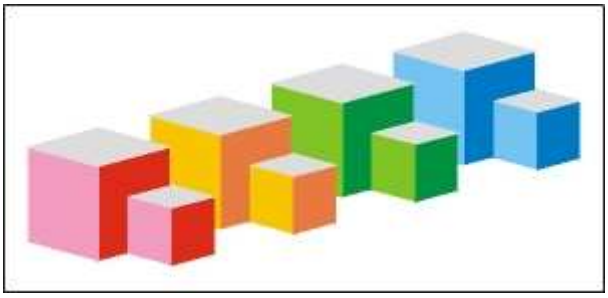


3D Grid with Small Objects



3D Grid with Large Objects

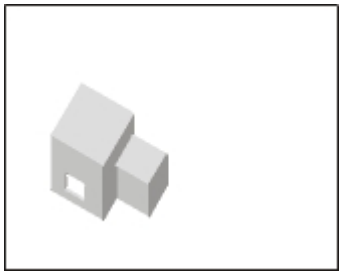
As seen in the above 2 Axonometric Illustrations, a common object has been sited on the horizon, and at 5, 15, 30 & 45 degrees. The only difference between the two is that the scale of the second is twice that of the first. As a result the distance from one object to the next has been shortened. Remember the axonometric projection is drawn to scale, so instead of positioning it on a particular grid, it can also be positioned by set dimensions. For example, below we have the same object sited equidistant to each other.



Sequence of Evenly Spaced Objects

Focal Point

So in an Axonometric Illustrations what determines where on the grid should the object be sited, and to what scale? This is where the context or purpose of that particular 'picture' comes into play. The first being what is the focal point?



Picture 1

Picture 2

Picture 3

In the examples above, the object in picture 1 is probably a part of a larger scene. Whereas picture 2 is focused on the actual object, and in picture 3 the focus is on a portion of that object. This is a typical example of how the focal point in Axonometric Illustrations will affect the scale of the object.

The next factor you need to establish before composing the picture is the line of vision. The first being the focal point, and the next would be viewing point. In other words, where is the viewer positioned and what is the viewer seeing? Both of which will be subject to the 'storyline' or purpose of that picture.

When positioning the object on the z-axis the dimensions of the object must be considered. Suppose the total height of the object is 5 meters (or 16 ft) and it is viewed from a height of 15 meters, then it's vertical position from the horizon would be 20 meters to the floor line. Note the horizon or eyelevel is always at zero.

For further information on related topics, go to http://www.peter-clements-art.com