Oblique and Axonometric Projection

OBLIQUE AND AXONOMETRIC PROJECTIONS are useful tools for designers and drafters. Several types and variations of each exist. Each has a different quality for displaying objects from different angles. It is important to know and understand the differences between oblique and axonometric drawings to take full advantage of the benefits. What is the best way to draw this 3D vector illustration of a Rubik's Cube?

Objective:

Review oblique and axonometric projections.

Key Terms:

axonometric projection
cabinet oblique
cavalier oblique
dimetric projection
general oblique
isometric projection
long-axis isometric
oblique projection
pictorial drawing
regular isometric
reverse isometric
trimetric projection

Understanding Oblique and Axonometric Projections

Knowing about and being able to create oblique and axonometric projections may enable you to receive desirable employment in terms of an internship.

OBLIQUE PROJECTIONS

An **oblique projection** is a drawing in which the observer is considered to be at infinity, and the plane of projection is parallel to the front surface of the object. It is a basic graphic projection used to produce pictorial 2D images of a 3D object.

Lines of Sight

The lines of sight in an oblique drawing are at an angle (or oblique) to the plane of projection. This allows you to see three faces or sides of the object. When you view an oblique projection, the front plane is parallel to your line of sight. As a result, it will appear in true size and shape. The other two planes, such as the top and sides, are at an angle to your line of sight.

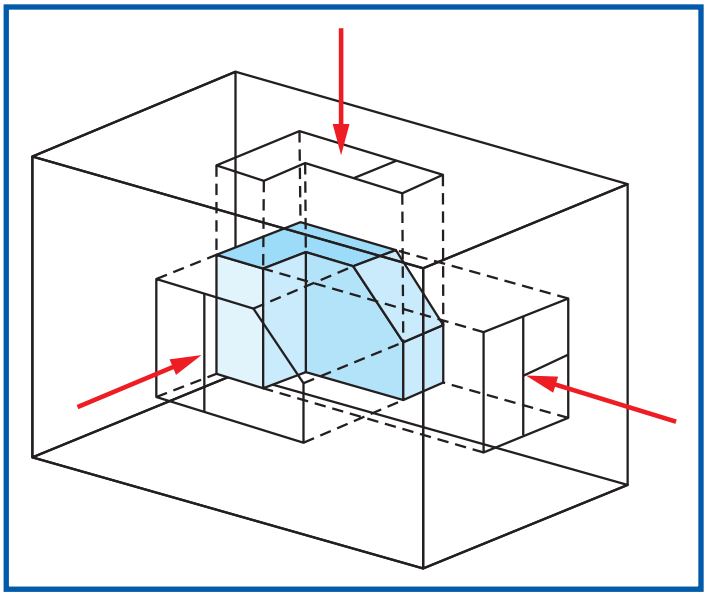


FIGURE 1. An oblique projection allows you to see three sides of an object at one time, as seen in this projection.

Circular Objects

Oblique drawing is useful when one face of the object needs to be shown flat. The oblique projection provides an easy method for drawing circular objects parallel to the plane of projection. Angles and circles parallel to the front projection plane are in true size and shape. This makes it easy for you to draw them. It is common to pick the side view, with the most circles or angles, as the front view. It is more difficult to draw circles on the top or side views because they are at an angle. In an oblique projection, the depth of the object in the angled view can be distorted. So you must compensate for this if you want to represent the object in a realistic manner.

Manual Drafting

Oblique projection is primarily used in manual drafting. Typically, there is no need to create oblique drawings using computer-aided design and drafting because once you create a 3D model, the computer can automatically generate isometric or oblique drawings.

THREE TYPES OF OBLIQUE DRAWINGS

There are three types of oblique drawings: cavalier, cabinet, and general oblique.

FURTHER EXPLORATION...

ONLINE CONNECTION: How to Create Oblique Projections

Learning how to create oblique projections is a required skill for all designers and drafters. After a few exercises and instructions you can create quick, basic projections. Following along with a tutorial can be very instructional. Visit the web link at http://www.slideserve.com/keene/oblique-projection to learn all about oblique projections and their uses.

Cavalier Oblique

A **cavalier oblique** is a drawing typically created at an angle of 45 degrees from horizontal. This creates a viewing angle of approximately 45 degrees for the top and side views. So although you are looking directly at the front of the object, the side and top are projected back into space at an angle of 45 degrees. The receding lines of the top and side are drawn at their true size. For example, if the side is 8 inches deep, the actual length of the side on the drawing is 8 inches deep. The lines are not foreshortened or elongated. Objects that have a depth smaller than their width can be drawn with clarity in cavalier oblique.

Cabinet Oblique

A **cabinet oblique** is a drawing created at an angle of 45 degrees from the horizontal with the receding lines of the top and side drawn at half their size. For instance, if the side is 8 inches deep, the actual length of the side on the drawing is 4 inches deep. The lines are foreshortened.

Objects that have a depth much greater than their width can be drawn with clarity in a cabinet oblique. The term comes from cabinet designers who often drew cabinet designs manually using this method of oblique drawing.

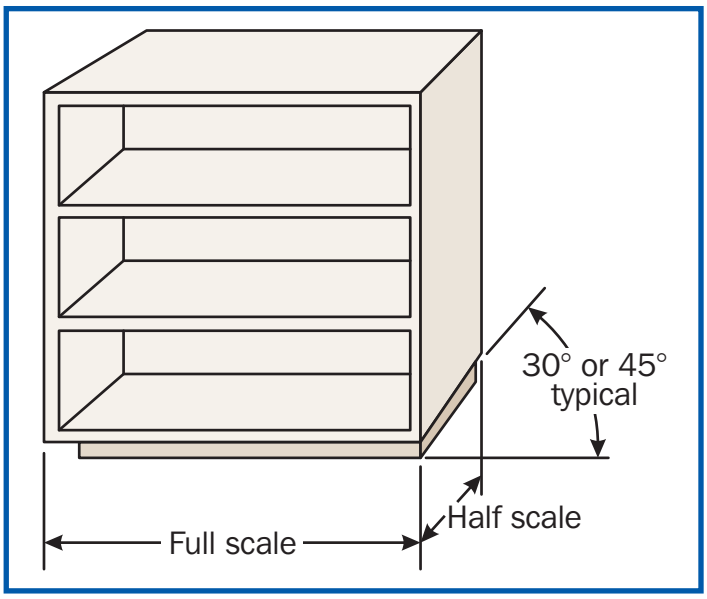


FIGURE 2. A cabinet oblique uses true sizes for the front, but this drawing type foreshortens the depth (usually by one-half the real length).

General Oblique

A **general oblique** is a drawing usually created at an angle other than 45 degrees. The most common angles for this type of oblique drawing are 30 degrees and 60 degrees. However, any angle can be used. You can draw the receding lines anywhere from half their size to full size.

AXONOMETRIC PROJECTION

Axonometric projection is a drawing that rotates the object with respect to the observer so all three dimensions may be seen in one view, approximately as they appear to the observer. You (the observer) are considered to be at infinity, and the lines of sight are parallel to each other and perpendicular to the plane of projection, unlike a perspective drawing where they recede to a single point.

Pictorial Drawing

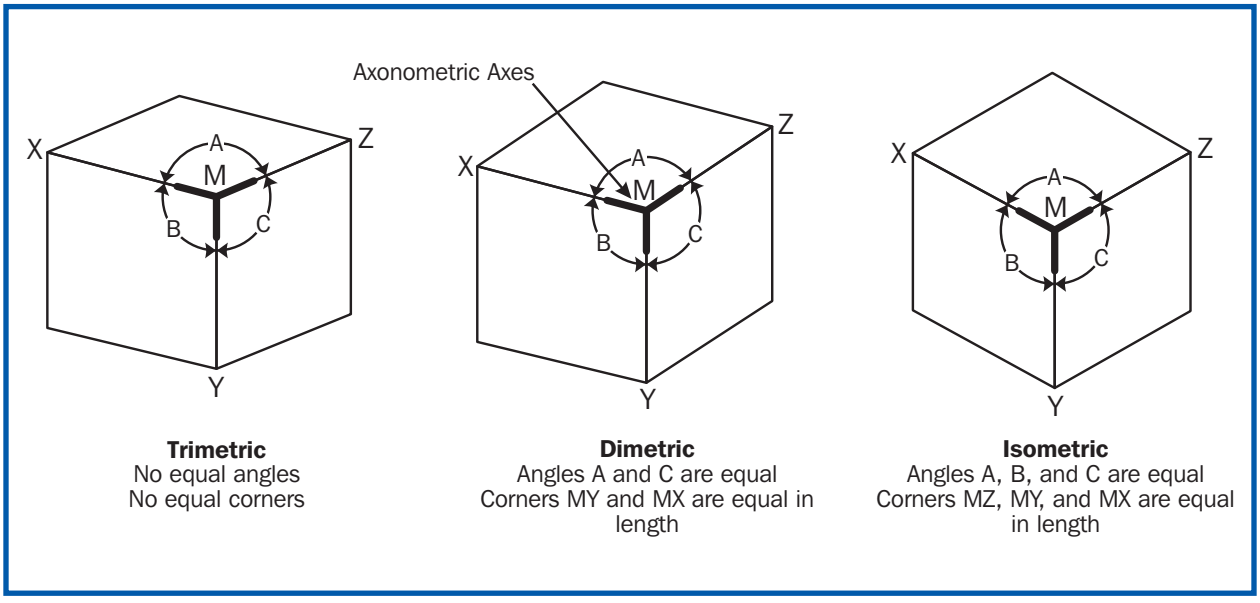
A drawing in axonometric projection is often referred to as a pictorial drawing. A **pictorial drawing** is a sketch that looks more like a picture than a multiview drawing. However, this drawing type is not used to describe detailed or complex objects because pictorial projections slightly distort the object as it recedes in space.

A pictorial drawing is used in the design process because it is quickly generated. This allows engineers and designers to view objects at various stages of development. Pictorial drawings are used in parts catalogs, technical reports, sales literature, instruction manuals, presentations, and as aids in the construction and assembly of products.

Axonometric Projection

A characteristic feature of axonometric projection is the inclined position of the object with respect to the projection plane. The size of the angles, the lengths of the lines, and the overall object proportions vary with an infinite number of possibilities because the principle edges and surfaces of the object are inclined to the plane of projection. In addition, you can place the object at any angle with respect to the projection plane.

The amount you can foreshorten receding lines depends on the angle with respect to the projection plane. More foreshortening can be occur with the use of a larger angle. The three edges of the object that meet at the corner nearest the viewer are often referred to as the axonometric axes. For example, if you had an axonometric projection of a cube, the closest point from which all the lines recede is the axonometric axis.



Trimetric
No equal angles
No equal corners

Dimetric
Angles A and C are equal
Corners MY and MX are equal in length

Isometric
Angles A, B, and C are equal
Corners MZ, MY, and MX are equal in length

FIGURE 3. An axonometric axis with the three types of axonometric projections.

TYPES OF AXONOMETRIC PROJECTIONS

Isometric means "equal measure." Therefore, an **isometric projection** is a method for visually representation in which all angles between the axonometric axes are equal. There are various types of isometric drawings.

Regular Isometric

A **regular isometric** is a drawing that shows a view from the top of the object; it is the most common type of isometric. It shows the front, one side, and the top of the object.

Reverse Isometric

A **reverse isometric** is a drawing that shows a view of the bottom of the object.

Long-Axis Isometric

A **long-axis isometric** is a drawing typically used for objects that are long (e.g., shafts). The object is placed along the long axis horizontally for the best view.

DIMETRIC PROJECTION

A **dimetric projection** is a visual representation that involves the use of two different scales. The true definition of diametric is "two measures." This type of projection allows you to foreshorten the projection planes at two different scales.

TRIMETRIC PROJECTION

A **trimetric projection** is a visual representation that uses three different scales for measurement. Trimetric means "three measures." In this type of projection, you can foreshorten each one of the three planes at different scales. Odd-shaped objects are typically used so when viewed as an axonometric drawing, they do not seem distorted.

Summary:

The lines of sight in an oblique drawing are at an angle to the plane of projection. This allows you to see three faces or sides of the object. Oblique drawing is useful when one face of the object needs to be shown flat. Three types of oblique drawings: cavalier, cabinet, and general.

A drawing in axonometric projection rotates the object with respect to the observer so all three dimensions may be seen in one view. An axonometric projection drawing is often referred to as a pictorial drawing. It is used in the design process because

it is quickly generated. Three types of axonometric projection are isometric, diametric, and trimetric. Isometric has equal scales; dimetric has two scales; and trimetric has three scales.

Checking Your Knowledge:

1. How many scales are used in a dimetric projection?
2. For which type of objects would you use a long-axis isometric projection?
3. What part of the object is viewed in a regular isometric drawing?
4. What are two common angles used in general oblique drawing?
5. Describe a drawing in oblique projection.

Expanding Your Knowledge:

Many tutorial books demonstrate ways to create oblique and axonometric projections. Stop by your school library to check out some of these books. You can quickly develop your skills by practicing some of the tutorial examples. You may benefit from the use of online tutorials as well.

Web Links:

Axonometric Projection
http://www2.tech.purdue.edu/cg/Courses/cgt164/Lectures/Isometrics.pdf

Isometric Drawing
http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html#isodrawing

Oblique Views
http://www.youtube.com/watch?v=1XApthNElAA

Oblique Projections
http://draftingmanuals.tpub.com/14276/css/14276_308.htm