Pictorial Drawing - Technical Illustration

Sacramento City College
Engineering Design Technology
Pictorial Drawing

- Pictorial drawing is part of graphic language.
- Used in:
  - Engineering
  - Architecture
  - Science
  - Electronics
  - Technical illustration, and
  - Other professions.
Examples of pictorial drawing use:

- Architects
  - Use pictorial drawing to show what a finished building will look like.
Pictorial Drawing
Examples of pictorial drawing use:

- Ad agencies
  - Use pictorial drawing to display new products.
Everything You Need to Protect Your Network

The ideal protection for every PC in your home or small office.

With Kaspersky Total Security™ you can manage the protection for every PC from a single computer remotely!

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Anti-phishing ensures your financial information is not accessible to criminal networks. Anti-spyware removes hidden programs that attempt to hijack your computer or prey on your personal information.

Share Ideas and Pictures Freely
All documents, images, audio and video sent via instant messaging and live streaming media (such as Skype, NetMeeting or Windows Messenger) are thoroughly scanned for infected content.
Pictorial Drawing

- Pictorial drawing is often used in exploded drawings on production and assembly drawings.
  - Refer to Figure 12-1
Pictorial Drawing

- Views are made to illustrate the operation of machines, and equipment.

- Pictorial sketches are used to help convey ideas that are hard to describe in words.
Pictorial Drawing

SPACE SHUTTLE ORBITER

LENGTH: 122 FT
WINGSSPAN: 78 FT
WEIGHT: 190,000 LBS
HEIGHT: 57 FT

STAR TRACKER PANEL
PAYLOAD BAY 40 FT.
RUDDER/SPEED BRAKE
ORBITAL PROPULSION
AFT REACTION CONTROL ENGINES
MAIN ENGINES(3)
BODY FLAP
LAUNCH UMBILICAL PANEL
ELEVONS
MAIN LANDING GEAR
SIDE HATCH
FORWARD ENGINES
UMBILICAL PANEL
NOSE LANDING GEAR
RIGHT HAND ILLUSTRATION
Parts are numbered in order of disassembly.
Pictorial Drawing

- Pictorial drawing can be
  - Perspective Views
  - Isometric Views
  - Oblique Views
Pictorial Drawing

- Pictorial drawing can be
  - **Perspective Views**
    - Show object as it actually looks to the eye.
    - Commonly used in architectural work.
    - Have non-parallel lines \((x, y, z)\)
Fig. 12-44  The lines of the sidewalk, roof, and building’s side appear to converge at a distance. (Courtesy of Mishima)
Fig. 12-49 When a building is viewed at an angle, two sides can be seen. The top and ground lines on each side appear to converge toward points. This is the effect in two-point, or angular, perspective. (Courtesy of Mishima)
Pictorial Drawing

- Pictorial drawing can be
  - Isometric Views
    - Easier to draw than perspective views.
    - Do not look as good as perspective views.
    - Commonly used in engineering work.
    - Have parallel lines (x, y, z)
Pictorial Drawing

- Pictorial drawing can be
  - **Oblique Views**
    - Easier to draw than perspective views.
    - Show less distortion than isometric views.
    - Have parallel lines (x, y, z)
    - Think “Front view + depth”.


Isometric Drawing
Isometric Drawing

- Pictorial drawings, in general, are made to show how something looks.
Since hidden lines are “not part of the picture” they are normally left out and are not drawn in isometric drawings.
Isometric Drawing

- Isometric drawing is
  - Similar to isometric sketching except that it is created using instruments.
Isometric Drawing

- Objects are aligned with three isometric axes at 120° angles to each other.
- Refer to Figure 12.4.
Isometric Axes

B

A

C

120°

120°

120°
Isometric Axes
Figure 12-3

ISOMETRIC
Isometric Drawing

- X, Y and Z axes
  - Must remain at 120 degrees to each other.
Isometric Drawing

- **Vertical Orientation - Regular Position**
  - **First position** –
    - the axes meet at the upper front corner of the object
  - **Second position** –
    - the axes meet at the lower front corner of the object.
Figure 12-4

VERTICAL

FIRST POSITION  SECOND POSITION

REGULAR
Figure 12-4

FIRST POSITION

SECOND POSITION

REVERSED

HORIZONTAL
Isometric Drawing

◆ **Horizontal Orientation - Regular Position**
  ◆ **First position** –
    ◆ the axes meet at the left front corner of the object
  ◆ **Second position** –
    ◆ the axes meet at the right front corner of the object.
Figure 12-4

FIRST POSITION
SECOND POSITION

REGULAR
Figure 12-4

FIRST POSITION

SECOND POSITION

REVERSED
Isometric Lines and Non-Isometric Lines
Isometric Lines

Any line parallel to one of the isometric axes is called an isometric line.
Non-isometric Lines
Non-isometric Lines

- Lines that are not parallel to one of the axes are called non-isometric lines.
Non-isometric Lines

- Measurements can be made only on isometric lines.

- Non-isometric lines do not show in their true length so they cannot be measured.
Non-isometric Lines
Non-isometric Lines
Drawing Non-Isometric Lines

- To draw non-isometric lines:
  - Locate the end points first.
  - Use the Box Method.
- Refer to Figure 12-6.
Drawing Non-Isometric Lines
Follow the procedure shown in Figure 12-7
- Construct angle parts AO, AB, OB
- Transfer AO and AB to the isometric cube
- Lay off AO on the base of the cube
- Draw AB parallel to the vertical axis
- Finally, connect points O and B to complete the isometric angle
Drawing Angles
Isometric Circles
In isometric drawings, circles appear as ellipses.
Drawing Isometric Circles

- Use the four centered approximation method to draw the ellipse.
  - Refer to Figure 12-9.
First, draw an isometric square, with the sides equal to the diameter of the circle.
Use a 30°–60° triangle to locate points A, B, C, D, and 1, 2, 3, 4.
**Drawing Isometric Circles**

- Use A and B as centers, and radius = A2, draw the arcs

With A and B as centers and a radius equal to A2, draw arcs as shown.
**Drawing Isometric Circles**

- Use C and C as centers, radius = C4, draw arcs to complete the ellipse.

With C and D as centers and a radius equal to C4, draw arcs to complete the isometric circle (ellipse).
Isometric Cylinder

◆ To draw an isometric cylinder
  ◆ Use Figure 12-9 to construct the top ellipse.
  ◆ Drop centers at a distance equal to the height of the cylinder.
  ◆ Draw three arcs using the same radii as the ellipse at the top.
    ◆ Notice that the radii for the arcs at the bottom match those at the top.
Isometric Cylinder

A

B

C

3.00

4.00
Isometric Quarter Rounds

To draw quarter rounds
- Refer to Figure 12-12.
- Follow procedure for quarters of circles.
- In each case measure the radii along the tangent lines from the corner.
- Then draw the perpendiculars to locate the centers for the isometric arcs.

Figure 12-13 shows how to draw outside and inside corner arcs.
Isometric Quarter Rounds

\[ \square = \text{RIGHT ANGLE (90°)} \]
Isometric Templates
**Isometric Templates**

- **Isometric templates** come in a variety of forms
  - $15^\circ, 30^\circ, 45^\circ, 50^\circ, 60^\circ$
  - They are convenient and can **save you** time.
Creating an Isometric Drawing
Creating an Isometric Drawing

- Measure True Length Lines from Orthographic Projection drawings.
  - Transfer Front View
    - X and Y
  - Top View
    - X and Z
  - Right Side
    - Y and Z
Creating an Isometric Drawing

- Filler Block Example
- Refer to Figure 12-17.

**Fig. 12-17** Steps in making an isometric drawing.
Creating an Isometric Drawing

- Filler Block Example
  - Draw the isometric axes in the first position.
Creating an Isometric Drawing

- Filler Block Example
  - Measure off the width, the depth and the height of the block on the three axes.
Creating an Isometric Drawing

- Filler Block Example
  - Draw lines parallel to axes to make the isometric drawing of the block.
Creating an Isometric Drawing

- Filler Block Example

Fig. 12-17 Steps in making an isometric drawing.
Reversed Axes

- To draw an object as if viewed from below, reverse the position of the axes.
  - Follow example in Figure 12-20.
Reversed Axes
Creating an Isometric Drawing

- When long pieces are drawn in isometric, make the long axis horizontal.
- Refer to Figure 12-21
Dimensioning Isometric Drawings
Isometrics are seldom used as Working Drawings.

Working Drawings are the drawings used to actually construct the object.

Isometric drawings are seldom dimensioned.

If dimensions are required, follow the newer unidirectional format.

Refer to Figure 12-22.
Dimensioning Isometrics-Manually

UNIDIRECTIONAL
Isometrics – Multiple Scales
Isometrics-Multiple Scales

- **Isometric**
  - Only one scale is used

- **Dimetric**
  - Two scales are used.

- **Trimetric**
  - Three scales are used.
Isometrics-Multiple Scales

ISOMETRIC

DIMETRIC

TRIMETRIC
Oblique Drawings
Oblique Drawings

◆ Oblique drawings are
  ◆ Similar to isometric drawings,
  ◆ Are drawn on three axes (X, Y, Z).
  ◆ Two axes are parallel to the picture plane (the plane on which the view is drawn).
  ◆ These two axes always are at right angles.
  ◆ Think “Front View with depth”.
**Oblique Drawings**

- In isometric drawings, only *one axis is parallel to the picture plane*.
- Refer to Figure 12-28.
Oblique Drawings

- Oblique drawings show an object as if viewed face on.
- The object is seen squarely with no distortion.
Oblique Drawing Rules

To create an oblique drawing:

- Draw a front view, long side horizontal
- Draw the depth
- Refer to Figure 12-29.
Fig. 12-29 Two general rules for oblique drawings.
Oblique Projection

- Oblique projection is a way of showing depth.
- Depth is shown by projector lines.
- Projector lines represent receding edges of an object.
  - These lines are drawn at an angle other than 90° from the picture plane so they will be visible in the front view.
Oblique Projection

- Lines on these receding planes that are parallel to each other are drawn parallel.
- Refer to Figure 12-30.
Oblique Projection

- Because oblique drawing can show one face of an object without distortion it has a distinct advantage over isometric.

- Oblique drawings are useful for showing objects with irregular outlines.
Oblique Drawing Types

- **Cavalier Oblique**
  - receding lines are drawn **full length**.

- **Normal Oblique**
  - receding lines are drawn **3/4 length**.

- **Cabinet Oblique**
  - receding lines are drawn **1/2 length**
    - named this way because it is often used in the furniture industry

- Refer to Figure 12-32
Oblique Drawing Types

- Multiview
- Cavalier
- Normal
- Cabinet
Angles and Inclined Surfaces

- Angles that are parallel to the picture plane are shown full size.
- For all other angles, lay the angle off by locating both ends of the slanting line.
- Remember to lay off angles by measurements parallel to one of the axes.
Oblique Constructions

- **Oblique Circles**
  - Use the four-center method for ellipses.
  - Ellipse templates give better results.
  - If you use a template, block the oblique circle as an oblique square.
Perspective Drawings
A perspective drawing

- Is a three-dimensional representation of an object as it looks to the eye from a particular point.
- Look the most like photographs of all pictorial drawings.
- Lines on the receding planes that are actually parallel are not drawn parallel.
- These lines are drawn as if they were converging.
A perspective drawing

Is a three-dimensional representation of an object as it looks to the eye from a particular point.
A perspective drawing look the most like photographs of all pictorial drawings.
In a perspective drawing, lines on the receding planes that are actually parallel are not drawn parallel. These lines are drawn as if they were converging.
Perspective Drawings

- Perspective drawing is the most realistic looking of the Pictorial drawing family.

- **Two types** of perspective drawings:
  - One point.
  - Two point.
    - Often used in architecture
Perspective Drawing Definitions

- Refer to Figure 12-40
  - Sight lines which lead from the points on the card and converge at the eye are called visual rays.
  - The picture plane is the plane on which the card is drawn.
  - The station plane is the point from which the observer is looking at the card.
  - A horizontal plane passes through the observer’s eye. Where it meets the picture plane, it forms the horizon line.
**Perspective Drawing Definitions**

- Where the ground plane on which the observer stands meets the picture plane, it forms the **ground line**.
- The **center of vision** is the point at which the line of sight pierces the picture plane.
- The **line of sight** is the visual ray from the eye perpendicular to the picture plane.
- The point at which the receding axes meet (the projectors) is called the **vanishing point**.
Fig. 12-40 Some perspective terms.
Perspective Drawing Definitions

- If the object is seen from above, the view is **aerial or bird’s eye view**
- If the object is seen from below, the view is **ground or worm’s eye view**
- If the object is seen so that the line of sight is directly on it, the view is a **normal view**
... look at the same thing from 4 different perspectives!
Sketch 1
The “worms-eye” view
Sketch 2
The “mid-level” view
Sketch 3
The "high-level" view
Fig. 12-50  Multiview and isometric drawings of an object to be drawn in two-point perspective.
Factors That Affect Appearance

- In perspective drawing, the size of the object seems to change as you move toward or away from it.
  - Refer to Figure 12-42 for explanation
  - Each time the distance from the object is doubled, the object appears only half as large
Factors That Affect Appearance

- The shape of the object seems to change when viewed from a different position.
  - Looking at a square directly, the edges are parallel.
  - Looking at it from an angle, the edges seem to converge.
One Point Perspective

- **One-point perspective**, has one vanishing point, also called *parallel perspective*.

- **Two point** perspective drawings have two vanishing points. Also called *angular perspective*
Fig. 12-42  The size of an object appears half as large when the distance from the observer is doubled.
Fig. 12-44  The lines of the sidewalk, roof, and building’s side appear to converge at a distance. (Courtesy of Mishima)
Fig. 12-49 When a building is viewed at an angle, two sides can be seen. The top and ground lines on each side appear to converge toward points. This is the effect in two-point, or angular, perspective. (Courtesy of Mishima)
Placing Views

- The “working space” of a drawing is the area inside the border.

- Objects are never drawn directly touching the border.

- Objects are drawn so there is a space between the object and the border line.
  - Refer to Figure 5-28.
Fig. 5-28 Choice of views.
Figure 5-29
Placing Views

1. Add the width and the depth of the object.
Placing Views

1. Add the width and the depth of the object.

For the Base, Fig 5-63, p152,
- The width is: 7.50”
- The height is: 2.25” + 1.62”
- The depth is: 3.25”

Width + depth = 7.50 + 3.25 = 10.75
2. Measure the available drawing space inside the border **using the same scale that will be used to draw the object.**
3. Subtract the total width of the objects from the width of the drawing space.

For the BASE

- Width + depth = 7.50 + 3.25 = 10.75

Available drawing space width = 14.0
- 14.0 – 10.75 = 3.25

Divide the remaining available space by 4.
- 3.25 / 4 = 0.8125
- This is the amount of space that should be left for a border around the views.
Placing Views

3. **Add the height and the depth of the object.**

4. **Subtract this total from the height of the drawing space.**
   - For the BASE
     - Height + depth = 3.87 + 3.25 = 7.12
   - Available drawing space height = 8.0
     - 8.0 − 7.125 = 0.875
   - Divide the remaining available space by 4.
     - 0.875 / 4 = 0.21875
     - This is the amount of space that should be left for a border around the views.
Locating and Transferring Measurements
Locating Measurements

- Measurements made on one view can be transferred to another.
- This process also insures accuracy.
  - Refer to Figure 5-33.
Locating Measurements

A

B
1. **Draw upward from the Front view to locate width measurements in the Top view.**

2. **Draw downward from the Top View to locate width measurements on the Front View.**
Locating Measurements

A

B
Locating Measurements

2. Draw across to the Side view from the Front view to locate height measurements.
   Use a similar method to project height measurements from the side view to the front view.
Locating Measurements
Locating Measurements

- **Height of Front view** - transfer to Right-side view.

- **Depth measurements** show as vertical distances in the **Top view** and as horizontal distances in the **Right-side view**.
Locating Measurements

A

B
Locating Measurements

3. Depth measurements show as
   - Vertical distances - Top view
   - Horizontal distances - Right-side view

To **transfer** these measurements use
   - Arcs
   - 45° triangle
   - Dividers
   - Scale
Locating Measurements
Using Arcs to Transfer
Using Scale to Transfer
Using 45 Line to Transfer
Summary of Steps

◆ Follow a step-by-step method to insure accuracy
◆ Carry all views along together
◆ Do not attempt to finish one view before starting the others
◆ Use a hard lead pencil (4H or 6H) and light, thin lines for preliminary (layout) lines
◆ Use F, HB or H for final lines
Summary of Steps

1. Consider the Characteristic View first.
2. Determine the number of views.
3. Locate the views.
4. Block in the views with light, thin layout lines.
5. Lay off the principal measurements.
Summary of Steps

6. Draw the principal lines.
7. Lay off the measurements for details such as centers for arcs, circles and ribs.
8. Draw the circles and arcs.
9. Draw any additional lines needed to complete views.
Summary of Steps

10. Darken the lines where necessary to make them sharp and black and of proper thickness