Sketching, Line Types, and Types of Views

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Learning Objectives

❖ Sketching
  ■ Drawing straight lines and circles
  ■ Recognizing types of lines

❖ Types of views
  ■ Perspective
  ■ Multiview
  ■ Isometric
Sketching

1) Seeing -> 2) Imaging -> 3) Representing

E. G. Boring
Basic Line Strokes

<table>
<thead>
<tr>
<th>Straight</th>
<th>Slanted</th>
<th>Horizontal</th>
<th>Curved</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Straight" /></td>
<td><img src="image" alt="Slanted" /></td>
<td><img src="image" alt="Horizontal" /></td>
<td><img src="image" alt="Curved" /></td>
</tr>
</tbody>
</table>

Examples

- **“I” letter**
- **“A” letter**
- **“B” letter**
Upper-case Letters & Numerals

Straight line letters

I A E L V H F T

W X M Y Z K N

Curved line letters & Numerals

O C Q G D J U

P R B 8 3 S 2

1 0 9 6 5 7 4 &
1. Identify end points
2. Orient paper for smooth movement of your hand
3. Start at one end, make series of very light, short line (2.5cm), slightly overlapping, moving toward the end point
4. Overdraw with longer heavier strokes
### Basic Line Types & Application

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Style</th>
<th>Visible line</th>
<th>Thin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Continuous</td>
<td>____________</td>
<td>____________</td>
</tr>
<tr>
<td></td>
<td>Dash</td>
<td>____________</td>
<td>____________</td>
</tr>
<tr>
<td></td>
<td>Chain</td>
<td>_______ - _______</td>
<td></td>
</tr>
</tbody>
</table>

1. **Visible line**
   - Represent features that can be seen in the current view.

2. **Dimension line**
   - **Extension line**
   - **Leader line**
   - Indicate the sizes and location of features.

3. **Hidden line**
   - Represent features that **can not be seen** in the current view.

4. **Center line**
   - Represents symmetry, path of motion, centers of circles, axis of axisymmetrical parts.
Basic Line Types

An Example

- Arrowhead: 0.35 mm
- Dimension Line: 0.3 mm
- Extension Line: 0.3 mm
- Center Line: 0.3 mm
- Phantom Line: 0.3 mm
- Hidden Line: 0.3 mm
- Cutting Plane Line: 0.6 mm
- Center Line: 0.3 mm
- Chain Line: 0.6 mm
- Visible Line: 0.6 mm
- Short Break Line: 0.6 mm
- Section Line: 0.3 mm
- Leader: 0.3 mm
- Note: 0.5 mm
- Diameter: 1.5 mm
- Section: A-A
1. Sketch Boundary Square
2. Find Center; use that point to mark midpoint of edges
3. Mark 2/3 point on diagonal
4. Sketch small arcs, rotating the paper
5. Complete with light, short arcs
6. Draw over as for straight line
# Types of Lines

<table>
<thead>
<tr>
<th>Weight</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible</td>
<td>Thick</td>
</tr>
<tr>
<td>(or Object)</td>
<td></td>
</tr>
<tr>
<td>Hidden</td>
<td>Medium</td>
</tr>
<tr>
<td>Center</td>
<td>Thin</td>
</tr>
<tr>
<td>Construction</td>
<td>Thin</td>
</tr>
<tr>
<td>Phantom</td>
<td>Thin</td>
</tr>
<tr>
<td>Extension/Dimension</td>
<td>Thin</td>
</tr>
<tr>
<td>Leader</td>
<td>Thin</td>
</tr>
<tr>
<td>Cutting Plane</td>
<td>Heavy</td>
</tr>
<tr>
<td>Short break</td>
<td>Thick</td>
</tr>
<tr>
<td>Long break</td>
<td>Thin</td>
</tr>
</tbody>
</table>
Example of Line Types
Types Of Views

- Multiview (Orthographic Projection)
- Axonometric Projection
- Oblique Projection
- Perspective Projection
View Types

Axonometric projection is a type of orthographic projection used for creating a pictorial drawing of an object, where the lines of sight are perpendicular to the plane of projection, and the object is rotated around one or more of its axes to reveal multiple sides.

Oblique projection is a simple type of technical drawing of graphical projection used for producing two-dimensional images of three-dimensional objects.

The distance and angles are not preserved and parallel lines do not remain parallel. Instead, they all converge at a single point called center of projection or projection reference point. There are 3 types of perspective projections which are shown in the following chart.
Important Terms

- **Station Point (SP)**
- **Picture Plane**
- **Horizon Line (HL)**
- **Ground Line (GL)**

Objects being observed
1. the point at which receding parallel lines viewed in perspective appear to converge.

2. the point at which something that has been growing smaller or increasingly faint disappears altogether.
Obtaining an Orthographic Projection

Note:
1) Line of site Perpendicular to Picture Plane
2) Parallel lines of Sight
Obtaining an Axonometric Projection

Note:
1) Line of sight perpendicular to Picture Plane
2) Parallel lines of sight

Observer at infinity

Line of sight (LOS)

Observer

Picture Plane
Types of Axonometric Drawings

Perspective is the only technique that does not use parallel lines of sight.

Axonometric Axes

TRIMETRIC
No equal angles
No equal edges

DIMETRIC
Angles A and C are equal
Edges MY and MX are equal in length

ISOMETRIC
Angles A, B, and C are equal
Edges MZ, MY, and MX are equal in length

Angles That Determine the Type of Axonometric Drawing Produced
Types of Axonometric Projections - 2

- When comparing their respective drawings, we observe that:

<table>
<thead>
<tr>
<th>Drawing Difficulty</th>
<th>Trimetric Drawings</th>
<th>Dimetric Drawings</th>
<th>Isometric Drawings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most difficult</td>
<td>Easier to produce</td>
<td>Easiest to draw and dimension</td>
<td></td>
</tr>
<tr>
<td>Most pleasing to the viewer</td>
<td>Less pleasing</td>
<td>Least pleasing</td>
<td></td>
</tr>
</tbody>
</table>
Examples of Axonometric Views

Examples

1. Isometric – all dimensions are the same scale
2. Dimetric – di = 2; 2 axes/dimensions foreshortened
3. Trimetric – tri = 3; 3 axes/dimensions foreshortened
Obtaining an Oblique Projection

Note:
1) Line of sight oblique to Picture Plane
2) Parallel lines of Sight
Oblique Drawings

- Cavalier oblique
- Cabinet oblique
- General oblique
Oblique vs Isometric

Isometric

Oblique

Ellipse

True Face

Circle
Obtaining a Perspective Projection

Note:
1) Lines of sight converge at station point
Determining Vanishing Points
Moving the VP Left and Right
VP, HL, and GL

Bird's Eye View—Ground Line Below Horizon Line

Human's Eye View—Ground Line 6' Below Horizon

Ground's Eye View—Ground Line on the Same Level as the Horizon Line

Worm's Eye View—Ground Line Above the Horizon Line
Perspectives

One-point perspective

Two-point perspective

Three-point perspective
Types of Projections

Perspective or Central Projections
- Linear Perspectives
  - One-Point Perspective
  - Two-Point Perspective
  - Three-point Perspective
- Aerial Perspectives
  - Aerial Perspective
    - Object features appear less focused at a distance

Parallel Projections
- Oblique Projections
  - Half Depth
  - Full Depth
  - Cavalier Projection
  - General Projection

Orthographic Projections
- Axonometric Projections
- Multiview Projections

Engineering Science
Isometric Sketches
Isometric Pictorials

**Isometric** means *equal measure*.

Three adjacent faces on a cube will share a single point. The edges that converge at this point will appear as 120 degree angles or 30 degrees from the horizon line.

These three edges represent height, width, and depth.
The Box Method

The *box method* is a technique used in sketching to maintain proportionality. It starts with a sketcher envisioning an object contained within an imaginary box.
Proportion and Estimation

Good sketching requires a sense of proportion, and the ability to estimate size, distance, angles, and other spatial relationships.
Isometric Sketching

The following examples show the steps used to create isometric sketches of simple geometric objects, along with tonal shading techniques.
Isometric Sketches

Step #1: Layout the box within which the isometric view will occur using points and construction lines.
Step #1: Constructing The Box
Isometric Sketches

Step #2: Use points and construction lines to identify surfaces that are not parallel to the faces of the box.
Step #2: Outside Faces
Isometric Sketches

Step #3: Trace out the visible edges of the part with thick, dark object lines.
Step #3: Object Lines
Step #1: Constructing The Box

Determine the overall dimensions of the object:
- 3 units wide
- 2 units tall
- 2 units deep

Use points and construction lines to layout the box.
Step #2: Outside Faces

Use points and construction lines to identify the corners and edges of the object faces that occur on the surface of the box.
Step #2: Outside Faces cont.

Before the sketch becomes too noisy with construction lines, trace out the visible edges identified thus far with object lines.
Step #3: Inside Faces

Use points and construction lines to identify the corners and edges of the object faces that occur inside the box.
Step #3: Inside Faces cont.

Trace out the remaining visible edges with object lines.
Step #4: Tonal Shading

Decide where the light source is coming from, and add tonal shading to two of the three views with parallel lines drawn closely together. Increase the contrast by cross-hatching the lines on the darkest face.
Describe how to obtain a multiview drawing from an isometric view. Bring graph paper to class. Check out the link:

http://incompetech.com/graphpaper/