What is “Perspective?”

• A mechanism for portraying 3D in 2D
• “True Perspective” corresponds to projection onto a plane
• “True Perspective” corresponds to an ideal camera image
ViewTransformations

• 3D world
  – Determine 3D camera viewpoint and orientation
  – Project 3D to 2D
  – Map 2D representation to physical device

  – Go to notes
ViewTransformations

• Viewport

Figure 3-17: Mapping the Viewing Volume to the Viewport
Orthographic

Top view

Side view

Front view
Engineering Drawing

Section AA
Isometric Projection
Isometric View
Cavalier Projection
Cabinet Projection
Positioning the Camera

• Use gluLookAt to specify
  – Eye location
  – “Look-at” point
  – “up” vector

• gluLookAt(10,10,10,1,2,3,0,0,1);
  – Eye is (10,10,10)
  – Look at point is (1,2,3)
  – Up is (0,0,1)

• Usually done in GL_PROJECTION matrix and combined with perspective matrix
Frustum

Figure 3-13: Perspective Viewing Volume Specified by glFrustum()
Perspective Projection

Eye = e
Gaze = LookAt = g
Up = y
Distance to viewplane = d
Z = distance to object on z axis
Figure 3-14: Perspective Viewing Volume Specified by gluPerspective()
Vanishing Points:
One Point Perspective
Vanishing Points:
Two Point Perspective
Perspective in Art

First ever painting (Trinity with the Virgin, St. John and Donors) done in perspective by Masaccio, in 1427.
Perspective in Art

A painting (The Piazza of St. Mark, Venice) done by Canaletto in 1735-45 in one-point perspective.
Perspective in Art

Painting in two point perspective by Edward Hopper

The Mansard Roof  1923; Watercolor on paper, 13 3/4 x 19 inches; The Brooklyn Museum, New York
Perspective in Art

A painting (City Night, 1926) by Georgia O'Keefe. Approximately in three-point perspective.
Many Kinds of Perspective Used

- Mechanical Engineering
- Cartography
- Art
Perspective in Art

• Naïve (wrong)
• Egyptian
• Cubist (unrealistic)
• Esher
• Miro
• Matisse
Egyptian Frontalism

- Head profile
- Body front
- Eyes full
- Rigid style
Uccello's (1392-1475) handdrawing was the first extant complex geometrical form rendered according to the laws of linear perspective (Perspective Study of a Chalice, Drawing, Gabinetto dei Disegni, Uffizi, Florence, ca 1430 1440)
Perspective in Cubism

Braque, Georges

Woman with a Guitar

Sorgues, autumn
1913
Perspective in Cubism
Pablo Picasso,
Madre con niño muerto (1937)
Pablo Picasso
Cabeza de mujer llorando con pañuelo
Perspective (Mural) Games

M C Esher,
Another World II
(1947)
Perspective

M.C. Escher, Ascending and Descending (1960)
M. C. Escher

M.C. Escher, Ascending and Descending (1960)
M. C. Esher

- Perspective is “local”
- Perspective consistency is not “transitive”
- Nonplanar (hyperbolic) projection
Nonplanar Projection

M C Esher,
Heaven and Hell
Nonplanar Projection

M C Escher,
Heaven and Hell
David McAllister

The March of Progress, (1995)
Joan Miro

The Tilled Field

Flat Perspective: What cues are missing?
Flat Perspective: What cues are missing?

Henri Matisse,
La Lecon de Musique
Henri Matisse, Danse II (1910)
Norway is at High Latitude
Engineering Drawing: Exploded View

Understanding 3D Assembly in a 2D Medium
Credits

• Slides and text
  – Rich Riesenfeld’s Introduction to CG slides
  – SIGGRAPH Educators Hypercard slides
    • http://www.siggraph.org/education/materials/HyperGraph/viewing/view3d/3dprojec.htm