The Art and Science of Depiction

Linear Perspective

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AHHHH...

UH-OH. SOMETHING IS SERIOUSLY WRONG HERE.

THE LAWS OF PERSPECTIVE HAVE BEEN REPEALED!

OBJECTS NO LONGER DIMINISH IN SIZE WITH DISTANCE!

LINES DO NOT CONVERGE TOWARD ANY POINT ON THE HORIZON!

ALL SPATIAL RELATIONSHIPS ARE LOST! IT'S IMPOSSIBLE TO JUDGE WHERE ANYTHING IS! OH NO!

CALVIN, QUIT RUNNING AROUND AND CRASHING INTO THINGS, OR I'LL SELL YOU TO THE MONKEY HOUSE!

...AND NOW SHE'S LOST PERSPECTIVE.
Assignments for Monday 30.

• Solso *Cognition and the Visual Arts*
  – Chapter 8 & 9

• Final project
  – Firm subject
Plan of the next sessions

- Drawing and projection
- Denotation
- Tone & color
Plan

- Intro to perspective
- History of Renaissance perspective
  - Early attempts
  - Bruneleschi
  - Alberti
  - De la Francesca
  - Leonardo
  - Dürer
- Gadgets
- Distortion issues
Perspective

• Does linear perspective “occur” in nature
  – E.g. we “experience” foreshortening
• Perspective or perspectives?
Pictorial depth cues

- Occlusion
- Size
- Position relative to the horizon
- Convergence of parallels, linear perspective
- Shading, shadow
- Texture gradient
- Aerial perspective
Introduction to Perspective

• Importance of the single viewpoint
Linear Perspective

- Image as a window
- *St Jerome In His Study*
  Antonello da Messina 1475
Some accompanying concepts

- Viewpoint
- Foreshortening
- Vanishing point
- Very linked to architectural spaces
Primary/secondary geometry

- Primary geometry
  - Description in 3D object-space
- Secondary geometry
  - Description in 2D image-space
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Early attempts

- St John the Baptist Retiring to the Desert
  Giovanni di Paolo 1454
Early attempts

- Giotto, 1297-1299
Early attempts

- Lorenzetti 1337-1340
Early attempts

• Lorenzetti 1337-1340
Giotto’s rules

- Lines and planes above eye level incline downwards when they move away
- Below eye level upwards when they move away
- Lines to the left incline inwards to the right
Giotto

- Confirmation of the Rule of St Francis 1325
Giotto

- Confirmation of the Rule of St Francis 1325
Early attempts

• Pietro Lorenzetti, *Birth of the Virgin* 1342
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Bruneleschi’s experiments, 1413

- Existing buildings
- Measurement, surveying
- Single viewpoint
- First scientific mimesis
Bruneleschi’s experiment, 1413
Bruneleschi’s second experiment

- Cut out
- Note that this is 2-point perspective
Limitations

• Existing buildings
• Requires measurement
Masaccio, The Trinity, 1427

- The oldest perspective painting
- Probably measurement
- Maybe helped by Bruneleschi
Masaccio, The Trinity, 1427

- The oldest perspective painting
- Santa Maria Novella (Florence)
Masaccio, The Trinity, 1427

- The oldest perspective painting
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Leon Battista Alberti, On Painting

- 1435
- Intersections of pyramids with image surface
- Proportional triangles
- Use side view for foreshortening
- Check with diagonal
- Use pavement as reference
- Center = prince of rays
Leon Battista Alberti, On Painting

• Paolo Uccello, *The Selling of the Host*, 1468
Legitimate construction

- Carlo Criveli
  Annunciation 1486
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Piero de la Francesca

- *De Prospectiva Pingendi*, 1474 (On the perspective of painting)
- Ratios of distance and size
- Use plan and elevation view
Piero de la Francesca

- Use plan and elevation view
Piero de la Francesca

- *De Prospectiva Pingendi*, 1474 (On the perspective of painting)
- Ratios of distance and size
- Use plan and elevation view
- Deformation of square
  - Angle of view less than 90°
Piero de la Francesca

- Flagellation of Christ, 1460
Piero de la Francesca

- Invention of the true cross 1452-59
- “wrong perspective on the left
Piero de la Francesca

- Invention of the true cross 1452-59
- “wrong perspective on the left
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Leonardo & perspective

- Techniques of artists’ perspective in theory and practice
- Geometry of visual rays
- Devices and instruments
- Optics and the eye
- Curiosities of vision (e.g. anamorphosis)
- Apparent contradictions
Leonardo

- *Last Supper*, 1497
Leonardo

- Last Supper, 1497
Leonardo & contradictions

- Wide angle vision
Leonardo & contradictions

- Wide angle vision
Leonardo & contradictions

- Wide angle vision
- Lateral recession
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Dürer

- Traveled to Italy
- Mainly influenced by de la Francesca
- *Instruction in Measurement with Compass and Ruler in Lines, Planes and Solid Bodies, 1525*
Dürer

• *St Jerome in his Study* 1514
• Very off-center
• Note the verticals
Dürer

- The artist’s glass
Dürer

- The draftsman's net
Dürer

- Jacob de Keyser's invention
Dürer

- Dürer’s device
Conclusions about Renaissance

• Different techniques, refinement
• Measurement
• Mainly central perspective
• No notion of infinity, no vanishing point
• Spiritual notion of mathematical harmony
After Renaissance

• 17th
  – Vanishing point
  – Abstraction
  – Desargues, Descartes
• Flourished until 19th
• 20th century
  – Come-back for computer graphics and computer vision
After Renaissance
• Thomas Malton
  A Complete Treatise on Perspective, 1779
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Gadgets

- Camera obscura
Vermeer 1660

- Camera obscura
Gadgets

- Baldassare Lanci’s universal instrument for surveying and perspective 1557

Instrument for Surveying and Perspective dates from 1557. As a perspective aid, it was used in a horizontal position, with an upright cylindrical drawing surface attached around half its rim. The artist looked through the sight arm, moving it around as he took in the scene. The drawing pin moved with the sight arm, allowing the key points of the design to be pricked out on the inside of the drawing surface.

Part of the surface engraving shows the instrument in use.
**Gadgets**

- **Camera Lucida**
- **E.g. Talbot**

Perspective
Perspective grids
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Perspective distortion

- The sphere is projected as an ellipse
Perspective distortion

- The sphere is projected as an ellipse