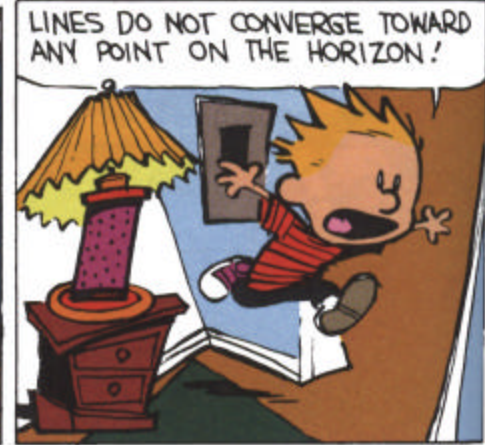
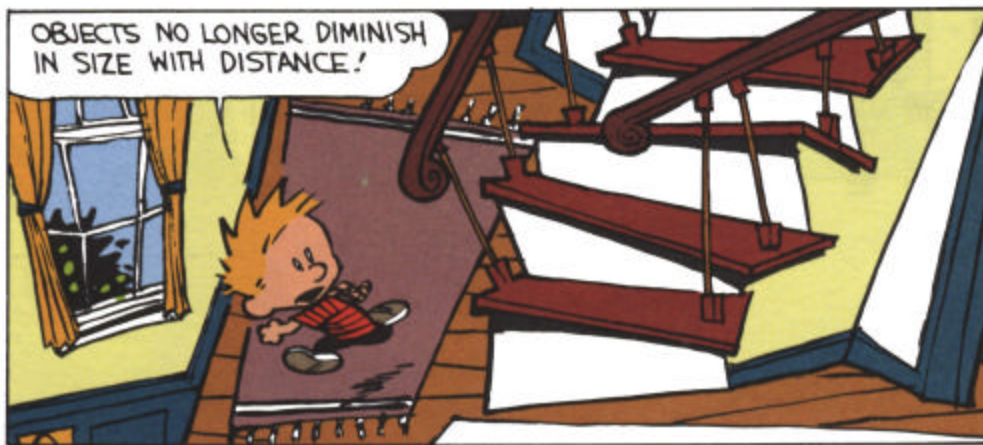


The Art and Science of Depiction

Linear Perspective

Fredo Durand

MIT- Lab for Computer Science



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

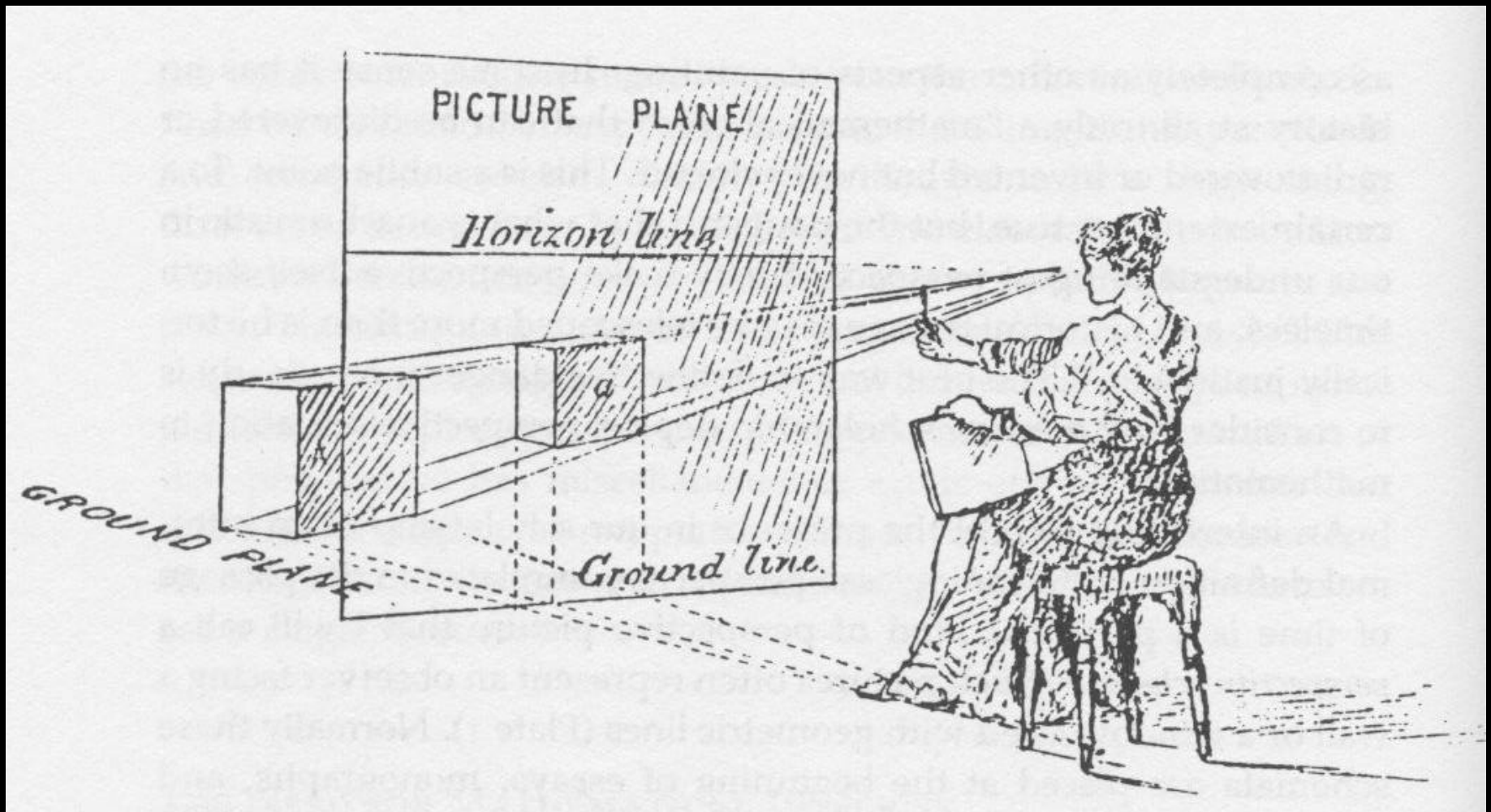
- Does linear perspective “occur” in nature
 - E.g. we “experience” foreshortening
- Perspective or perspectives?

Pictorial depth cues

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

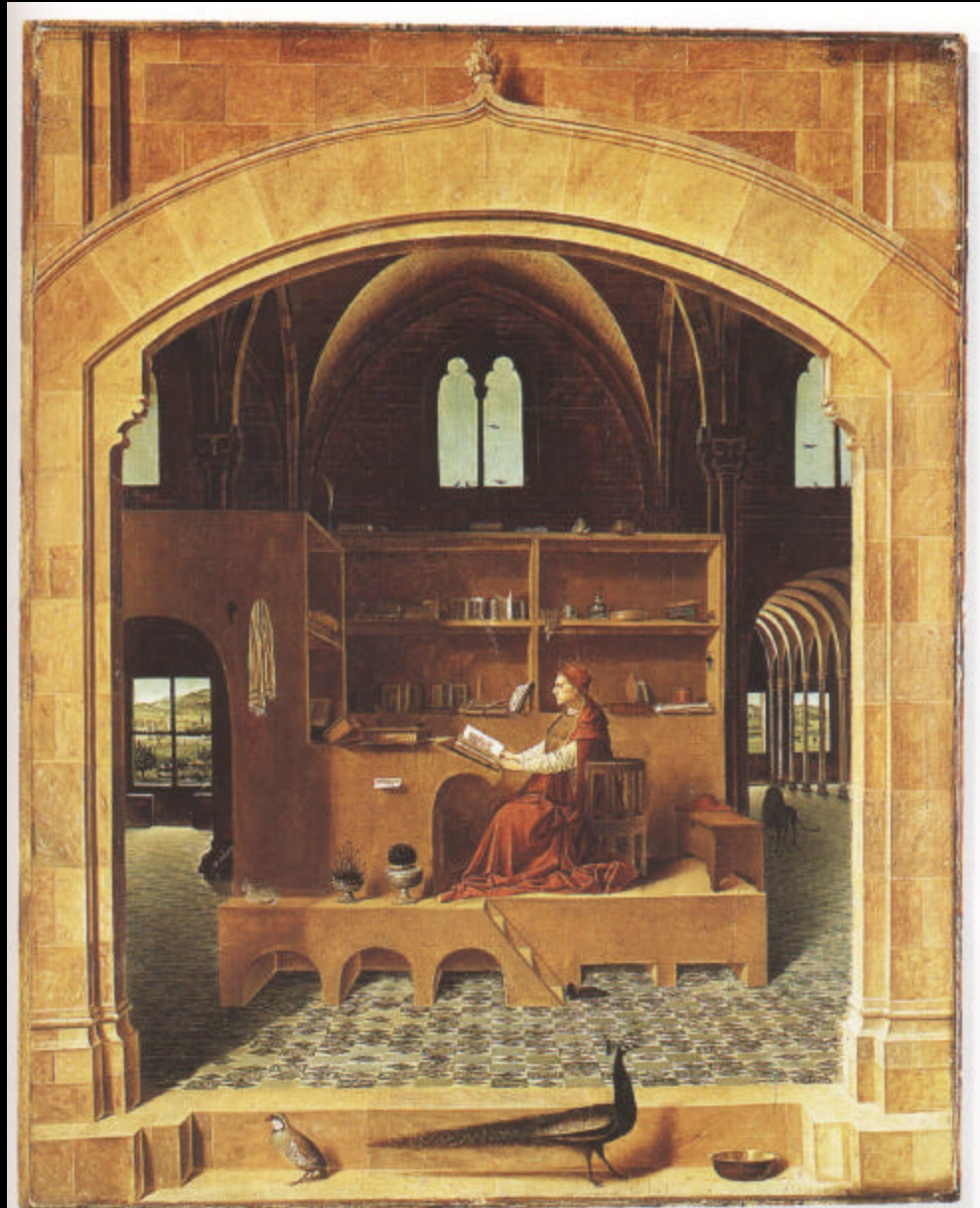
Introduction to Perspective

- Importance of the single viewpoint



Linear Perspective

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



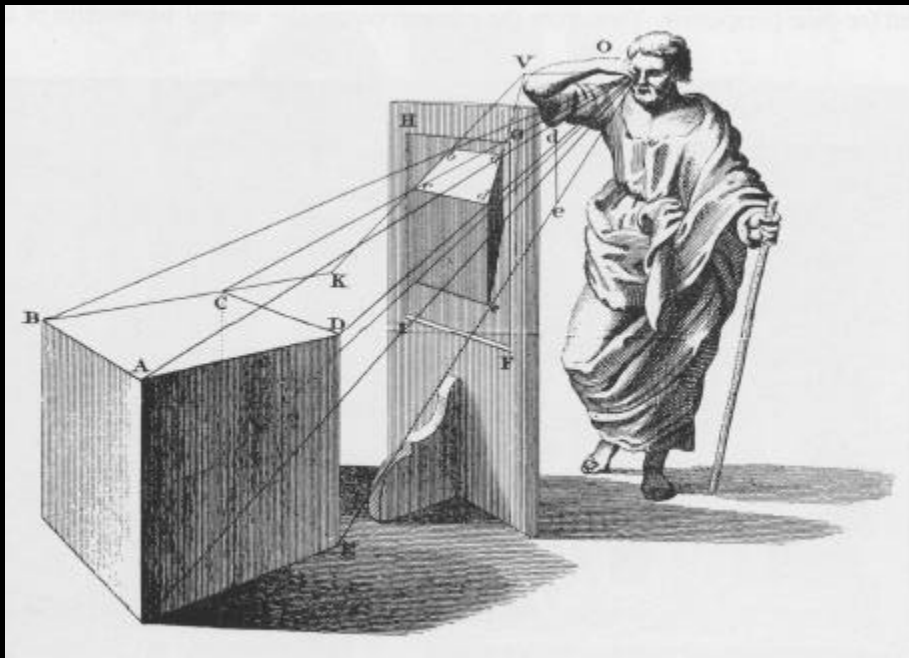
Some accompanying concepts

- Viewpoint
- Foreshortening
- Vanishing point

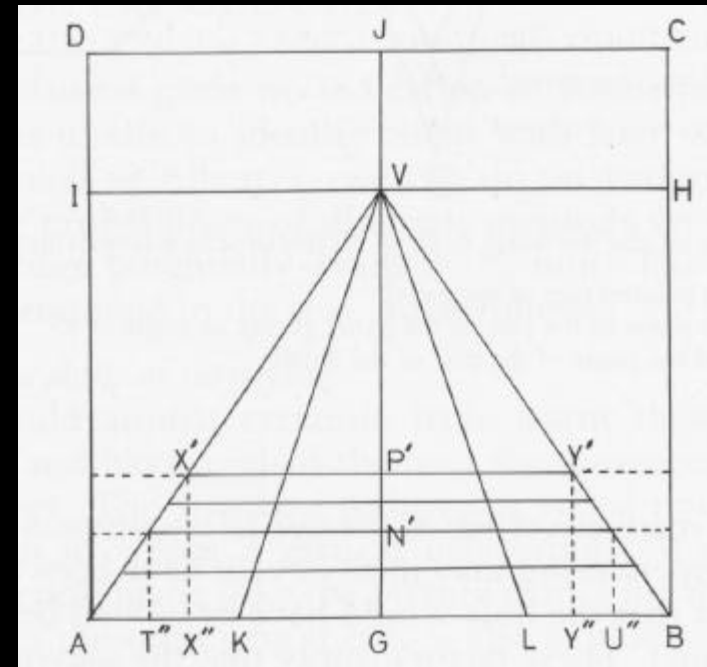
- Very linked to architectural spaces

Primary/secondary geometry

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



Perspective

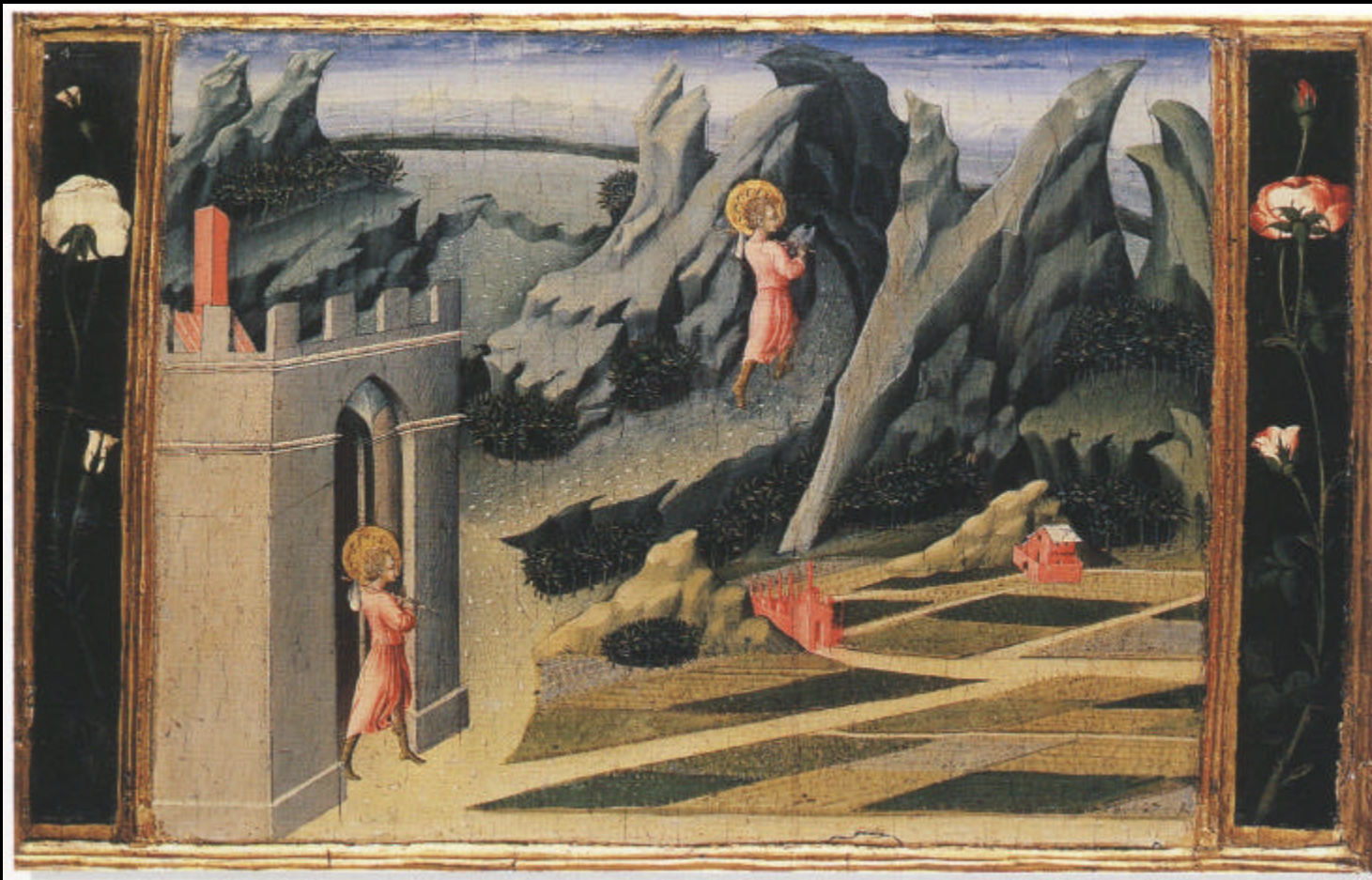


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Early attempts

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



Perspective

Early attempts

- Giotto, 1297-1299



Perspective

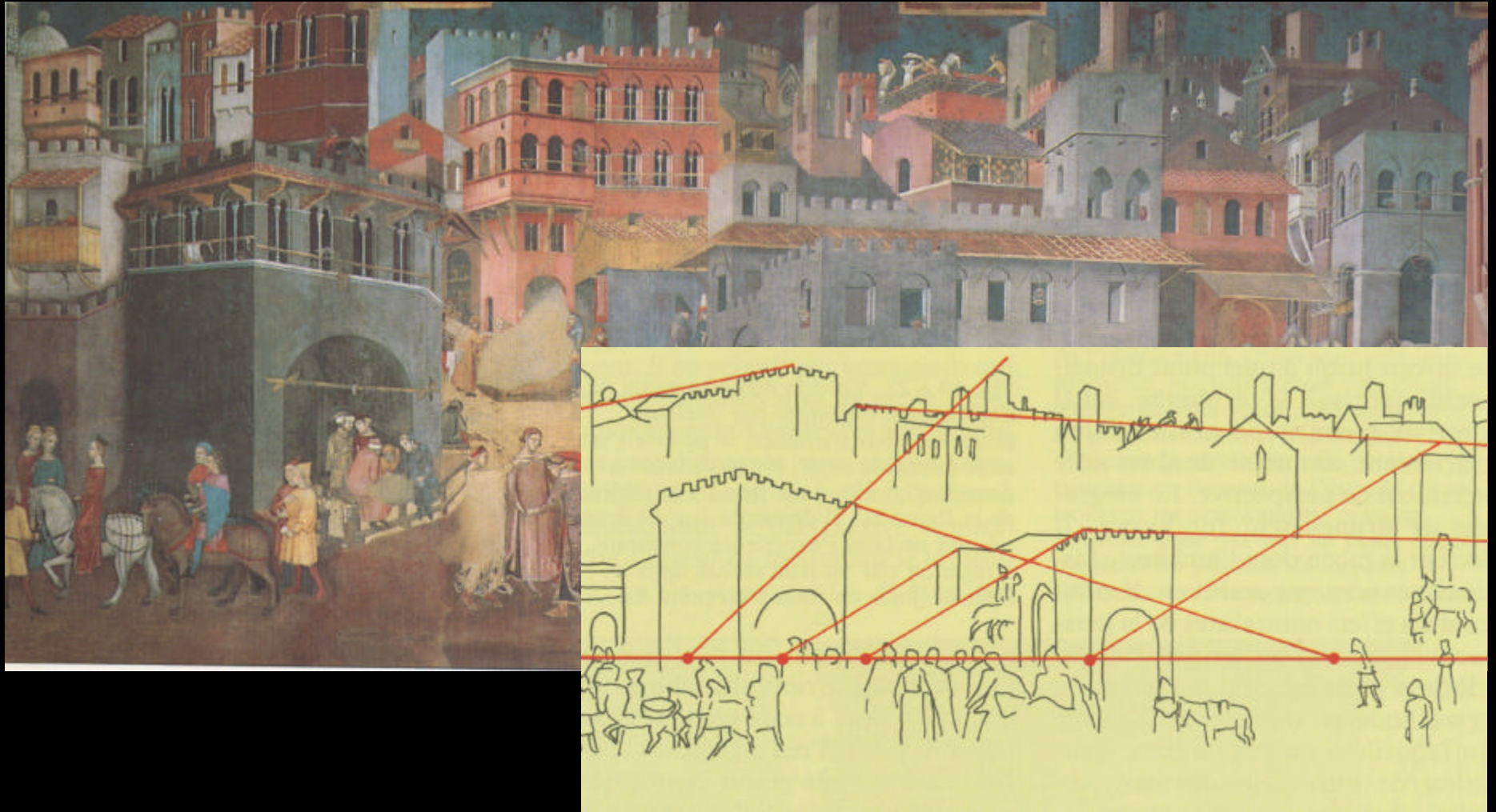
Early attempts

- 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

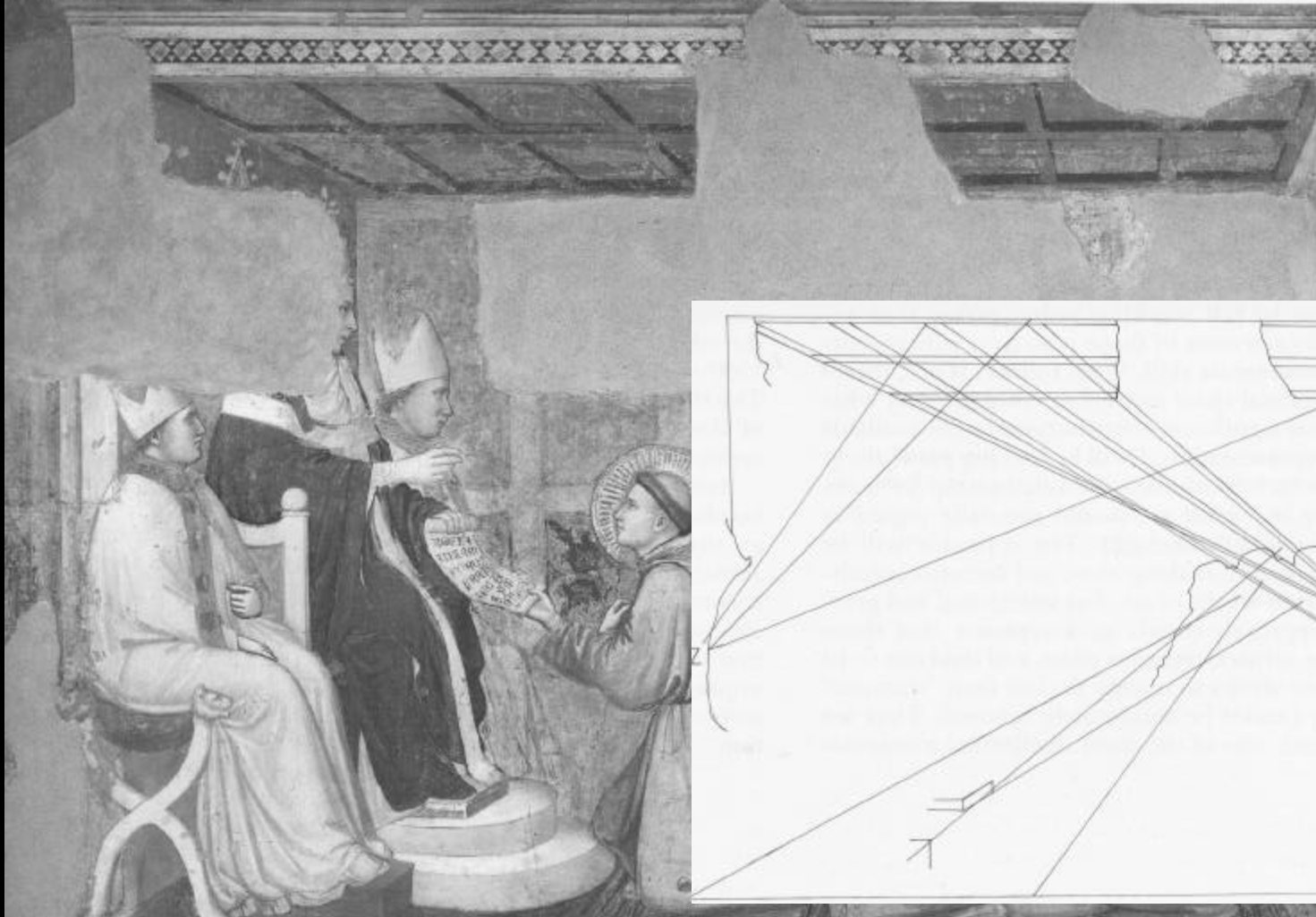
- Confirmation of the Rule of St Francis 1325



Perspective

Giotto

- Confirmation of the Rule of St Francis 1325



Perspective

Early attempts

- Pietro Lorenzetti,
Birth of the Virgin
1342



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Bruneleschi's experiments, 1413

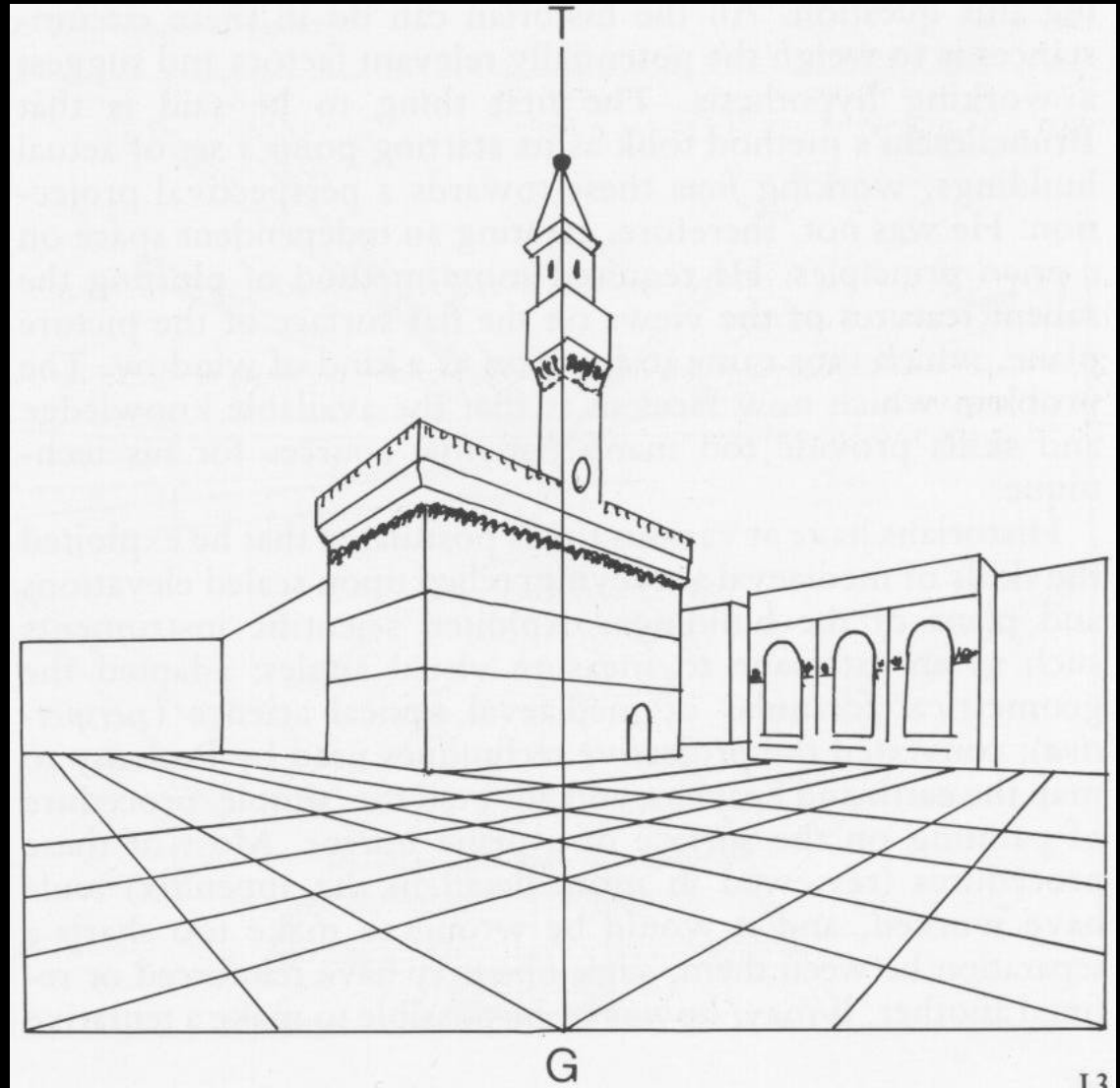
- Existing buildings
- Measurement, surveying
- Single viewpoint
- First scientific mimesis

Bruneleschi's experiment, 1413



Bruneleschi's second experiment

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

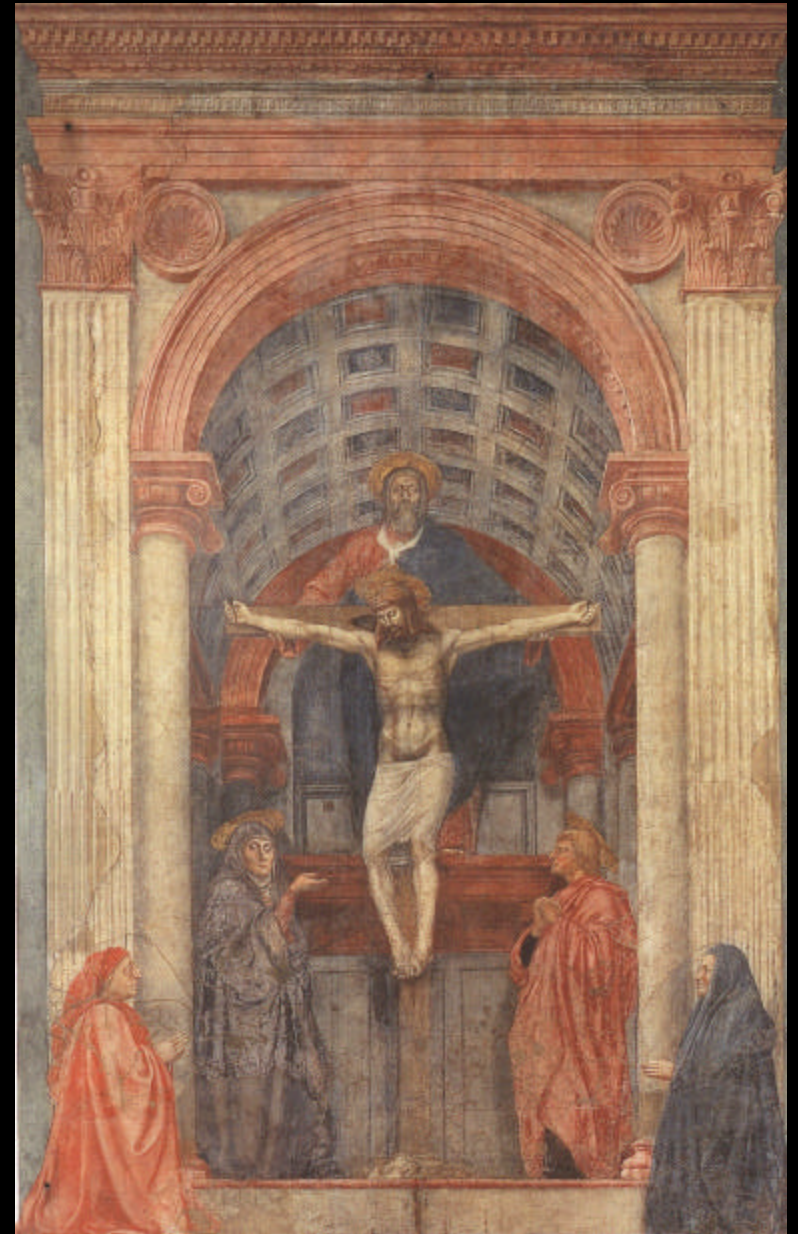


Limitations

- Existing buildings
- Requires measurement

Masaccio, The Trinity, 1427

- The oldest perspective painting
- Probably measurement
- Maybe helped by Brunelleschi



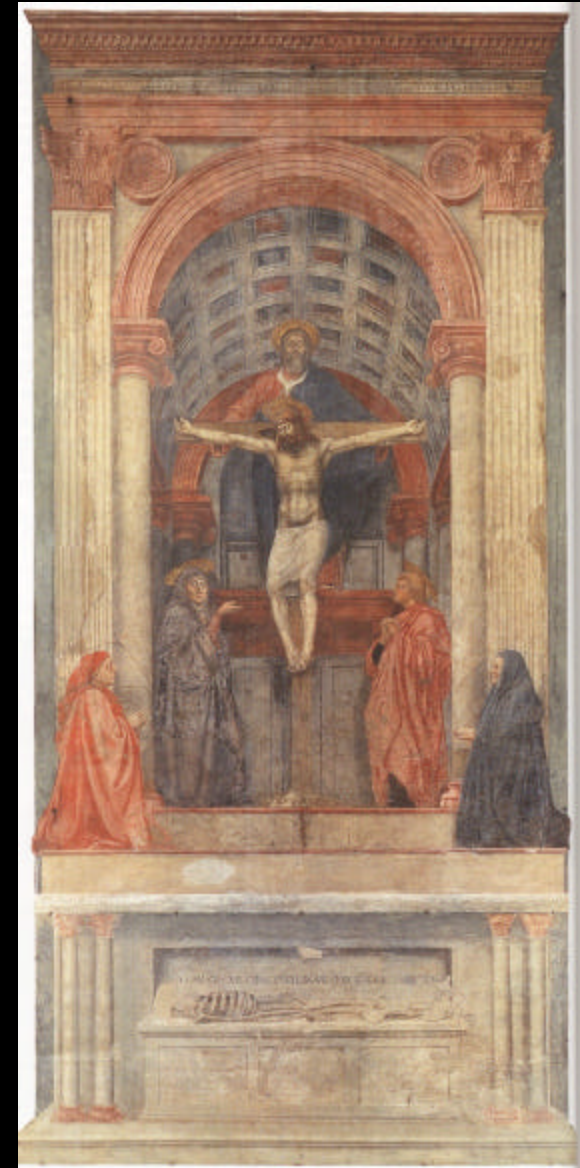
Perspective

Masaccio, The Trinity, 1427

- The oldest perspective painting
- Santa Maria Novella (Florence)

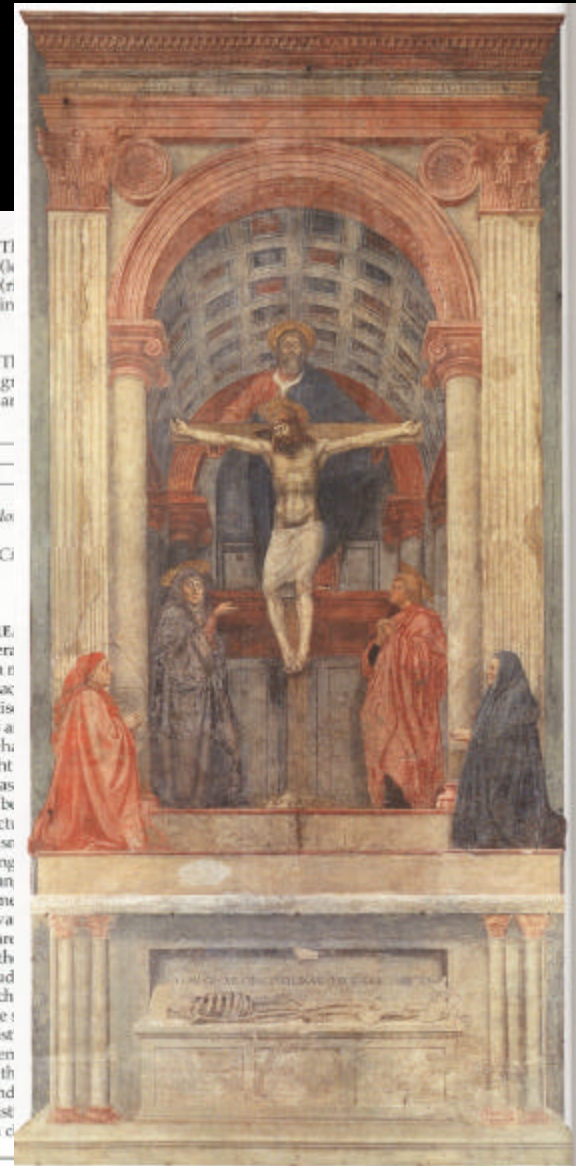
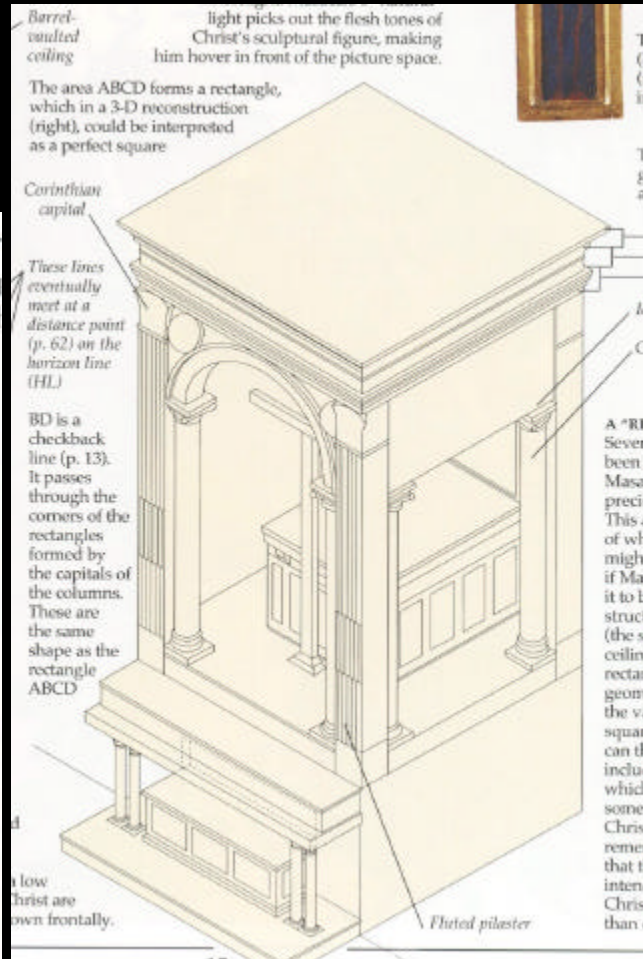
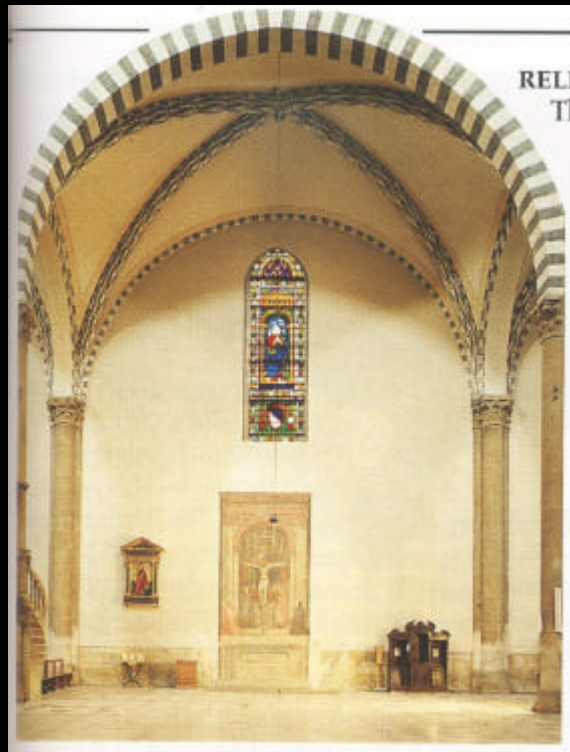


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Masaccio, *The Trinity*, 1427

- The oldest perspective painting

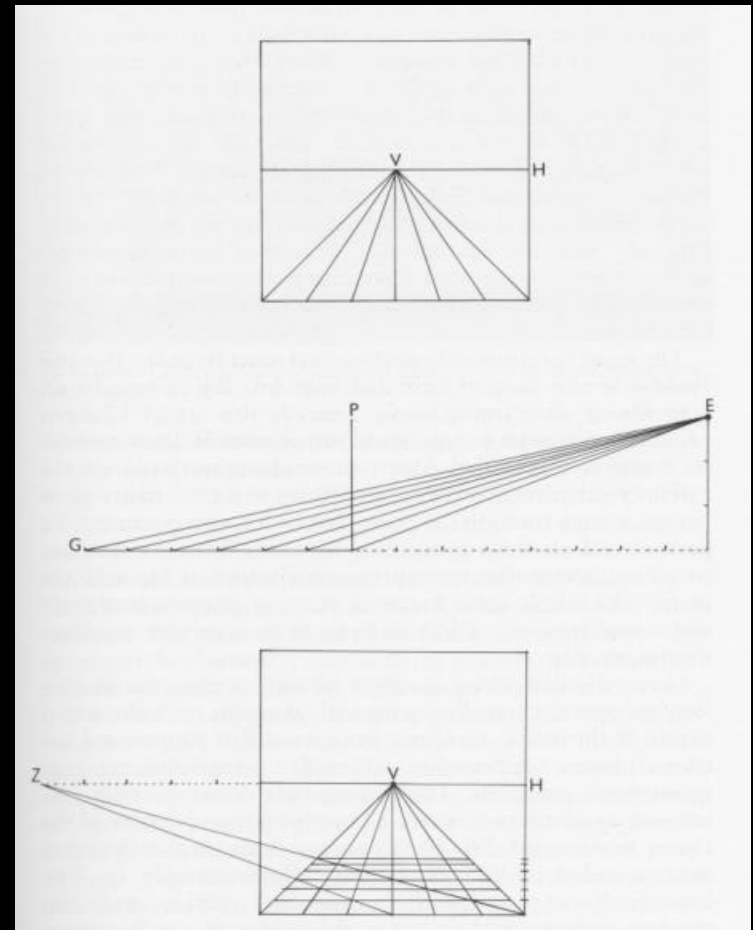


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Leon Battista Alberti, On Painting

- 1435
- Intersections of pyramids with image surface 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 Crivelli
Annunciation 1486



Perspective

Plan

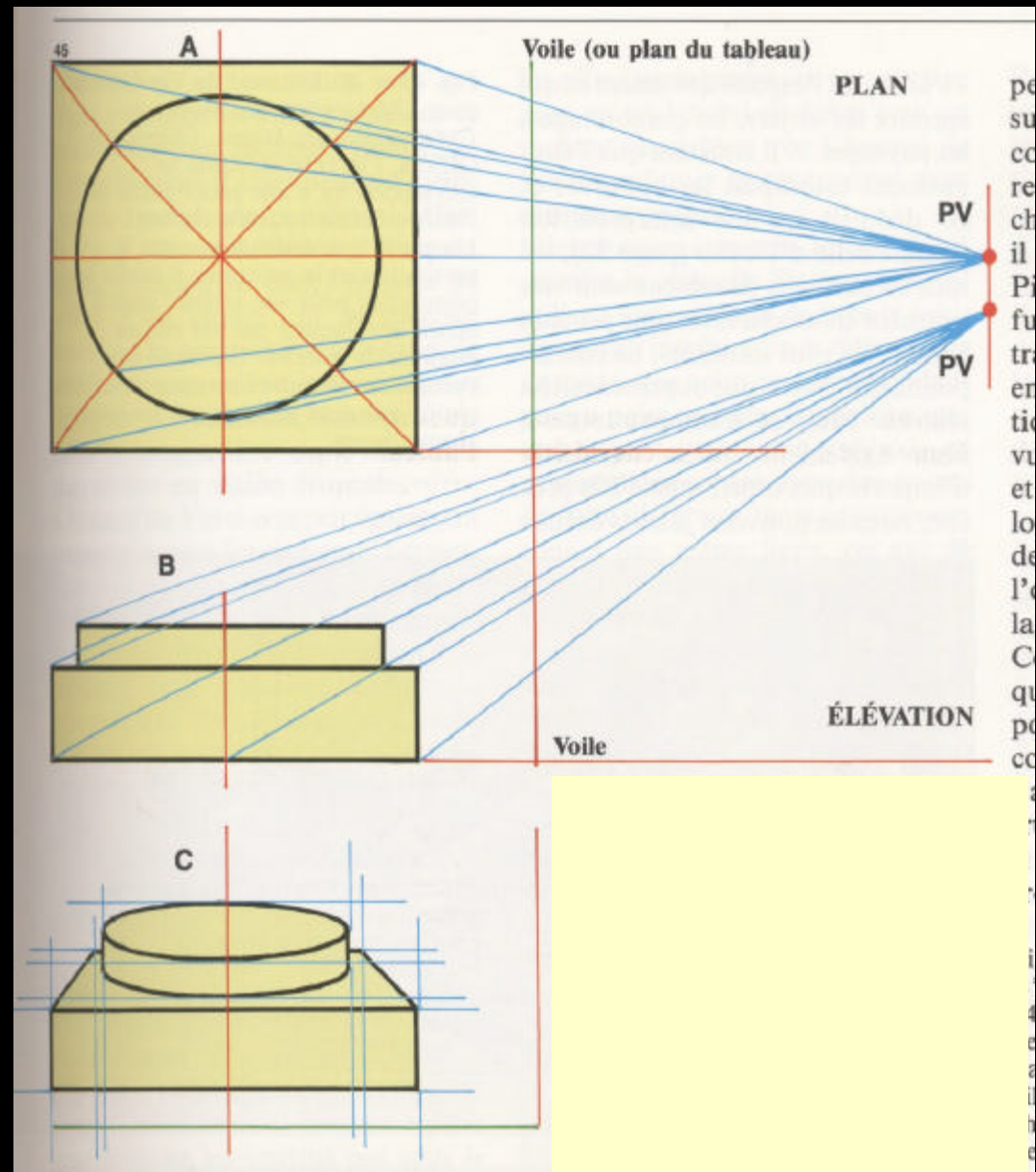
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Piero de la Francesca

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

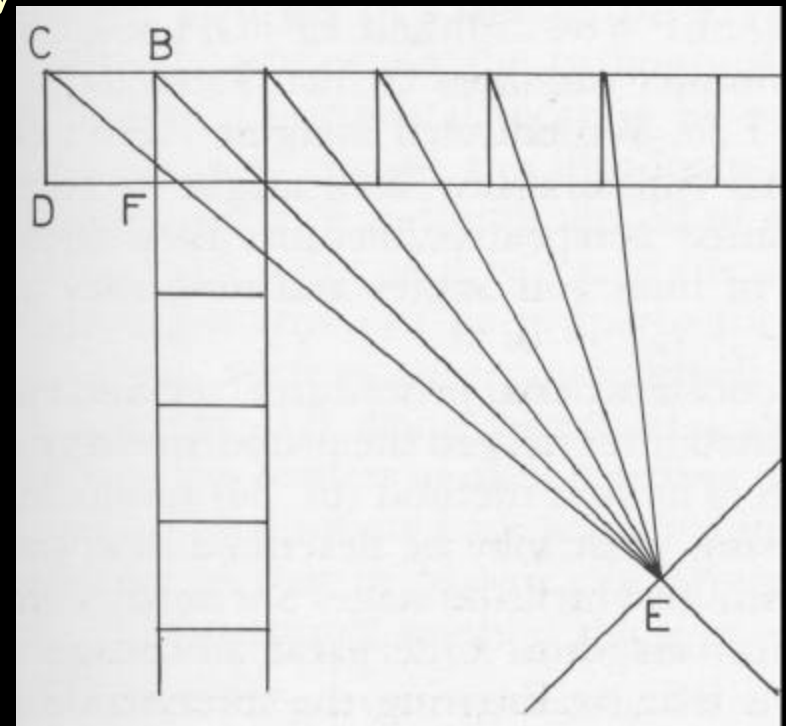
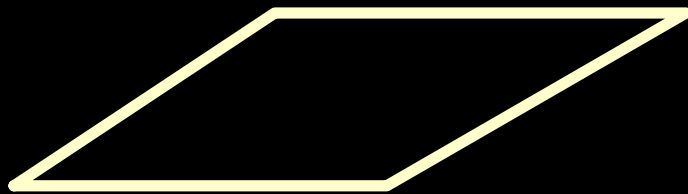
Piero de la Francesca

- Use plan and elevation view



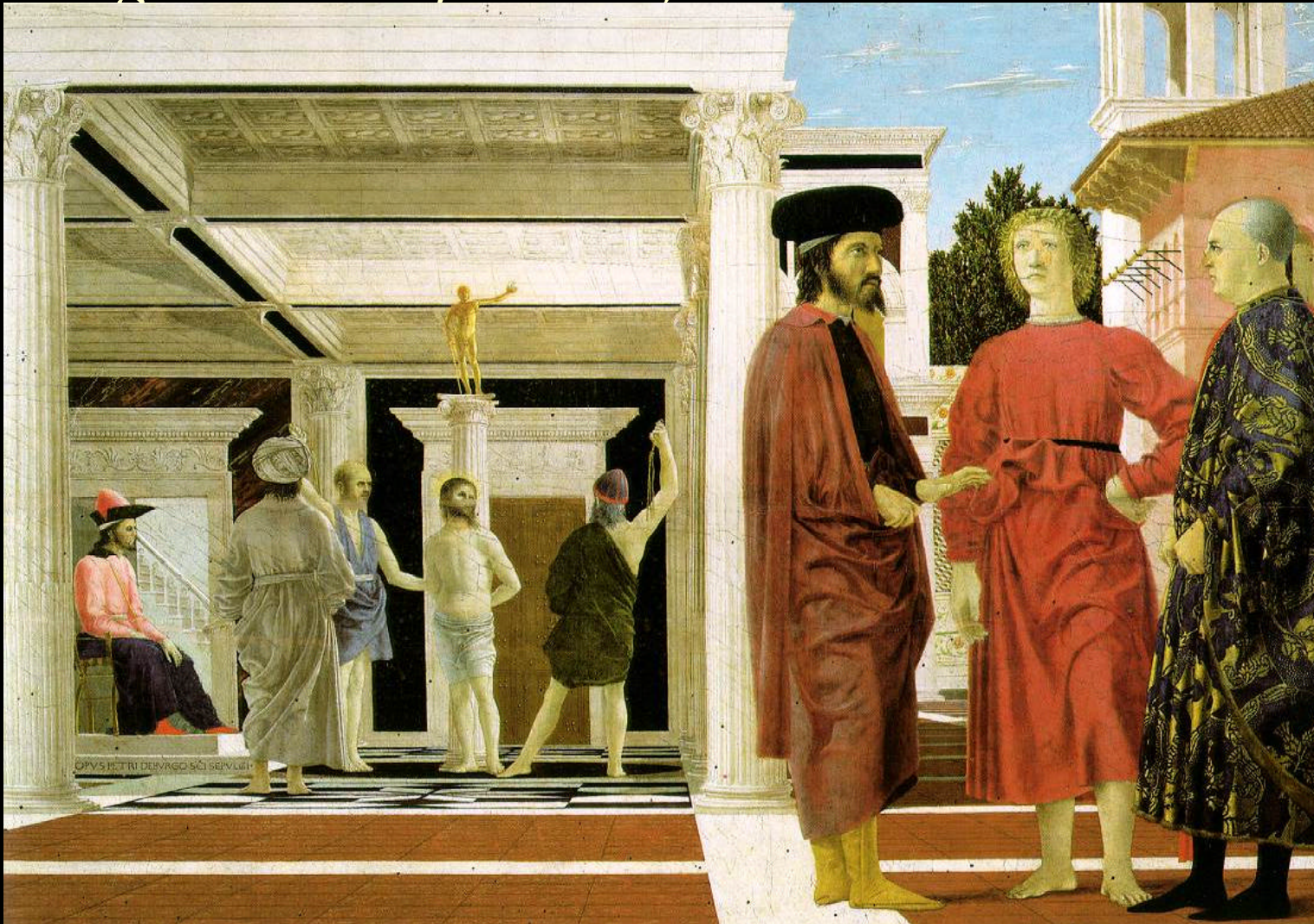
Piero de la Francesca

- *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



Perspective

Piero de la Francesca

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



Perspective

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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



Perspective

Leonardo

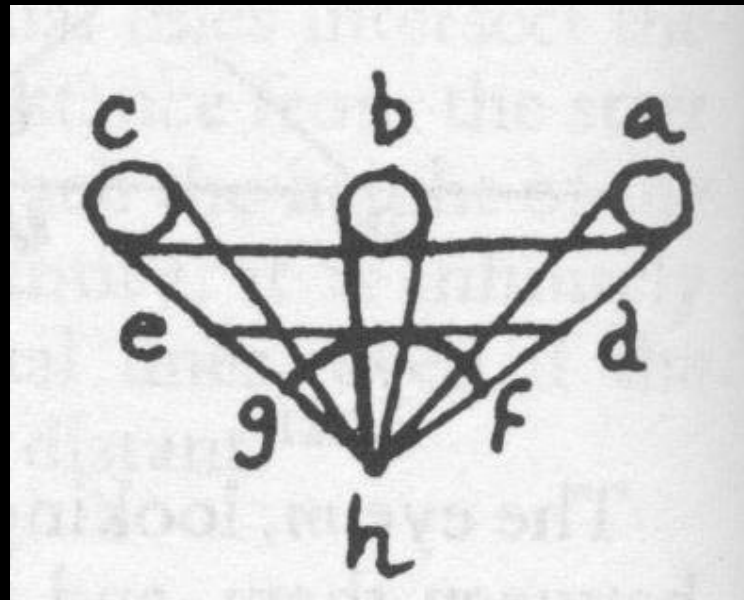
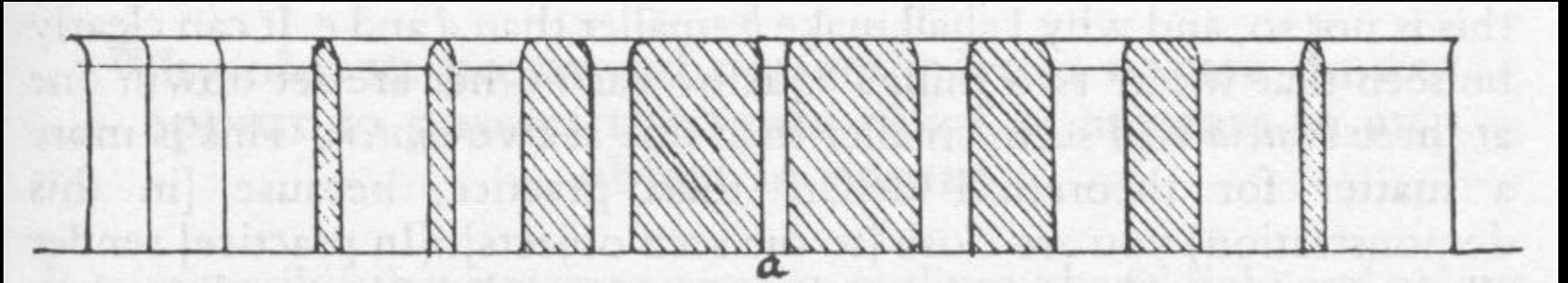
- *Last Supper*, 1497



Perspective

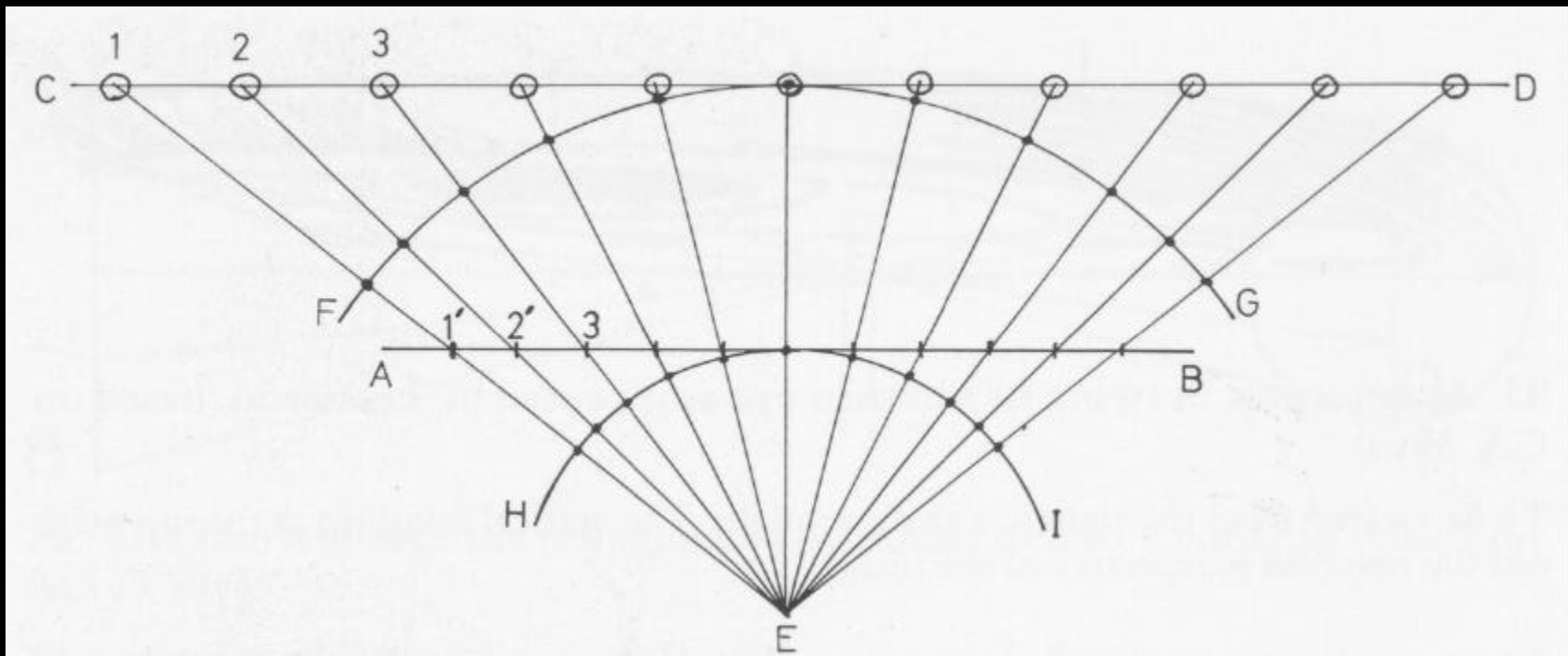
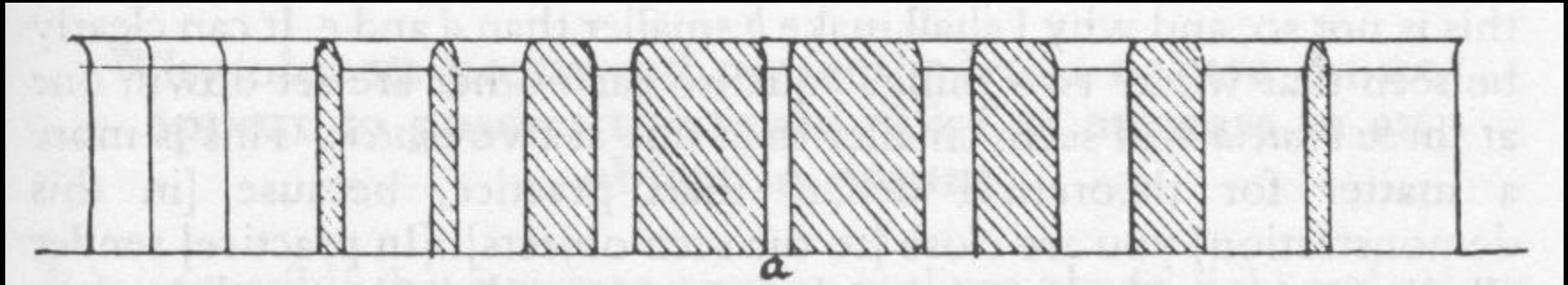
Leonardo & contradictions

- Wide angle vision



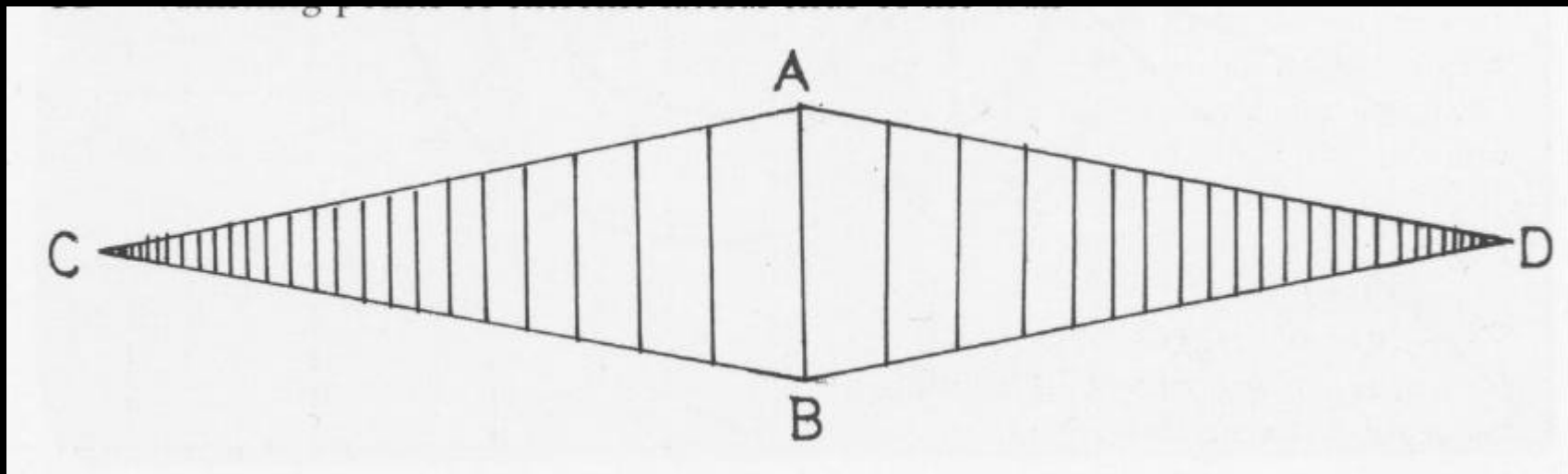
Leonardo & contradictions

- Wide angle vision



Leonardo & contradictions

- Wide angle vision
- Lateral recession

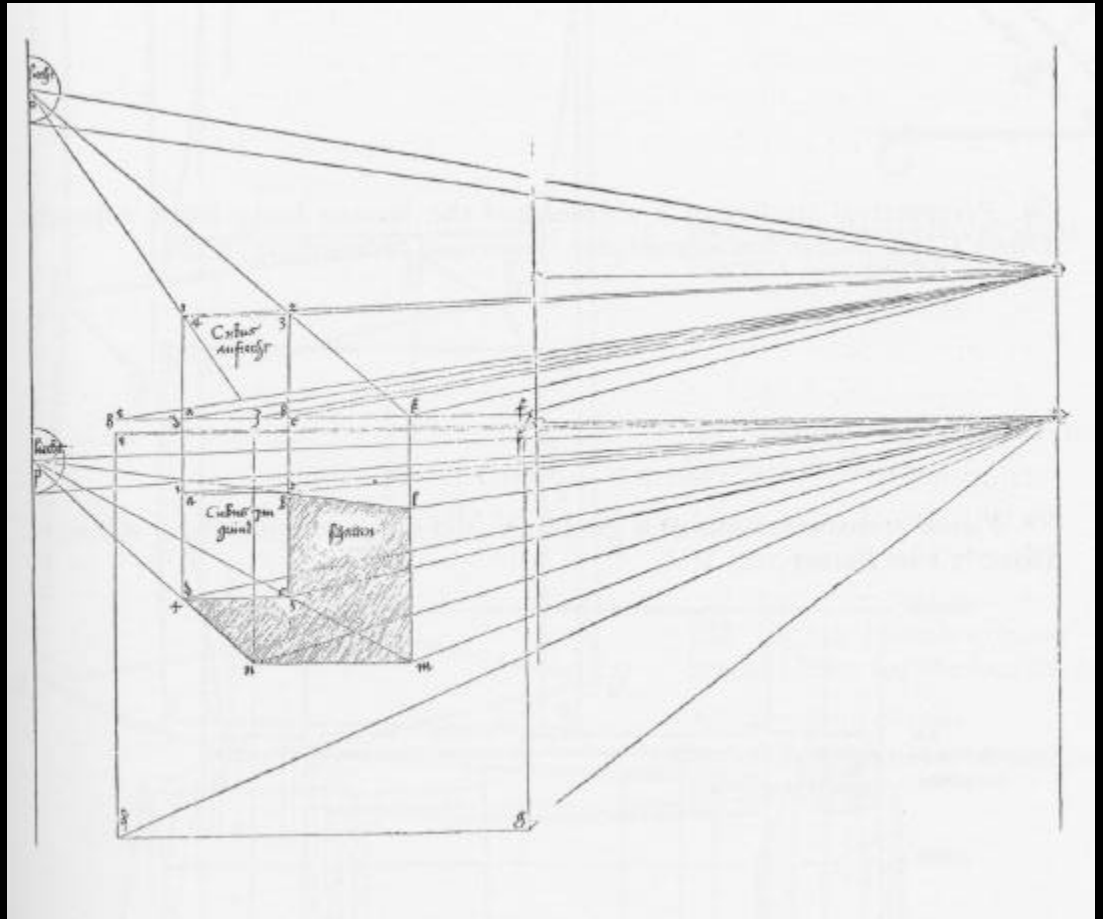


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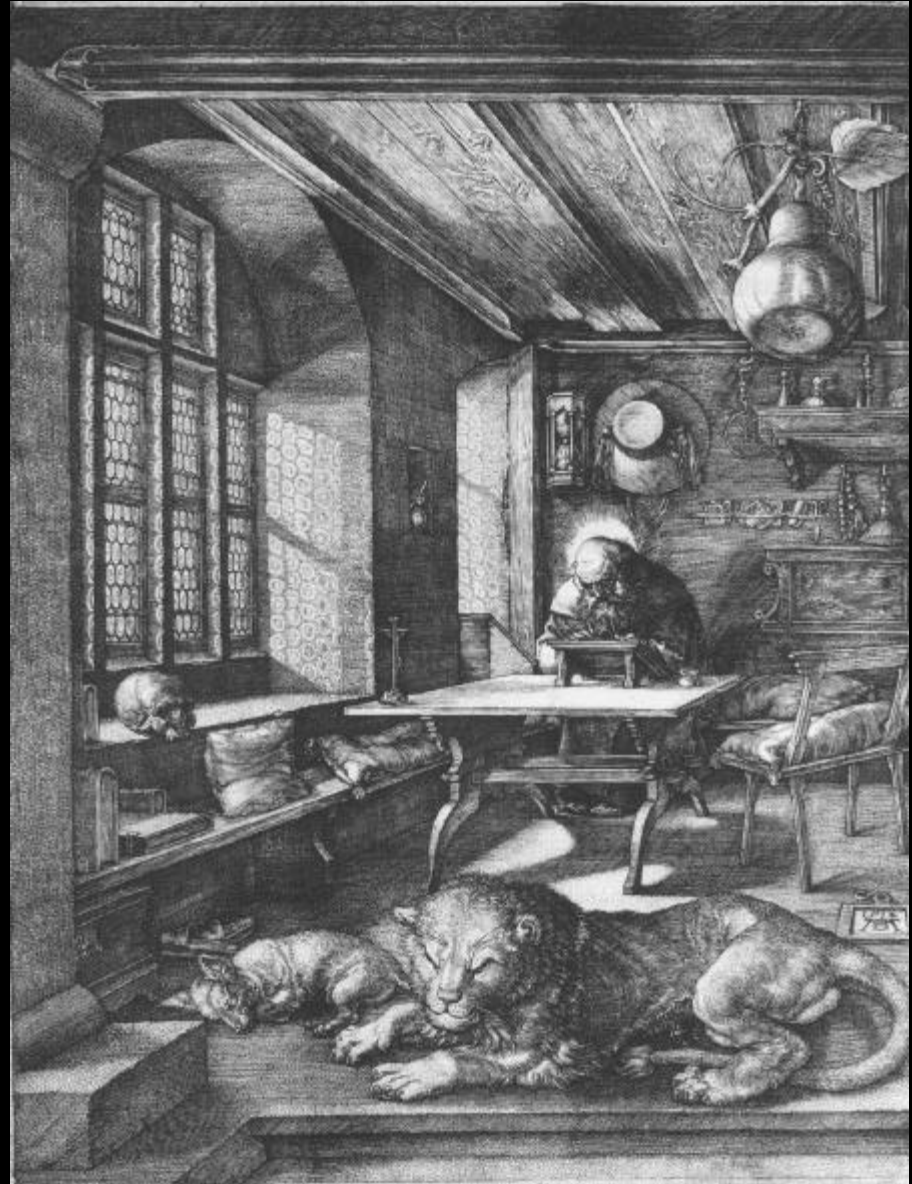
Dürer

- 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



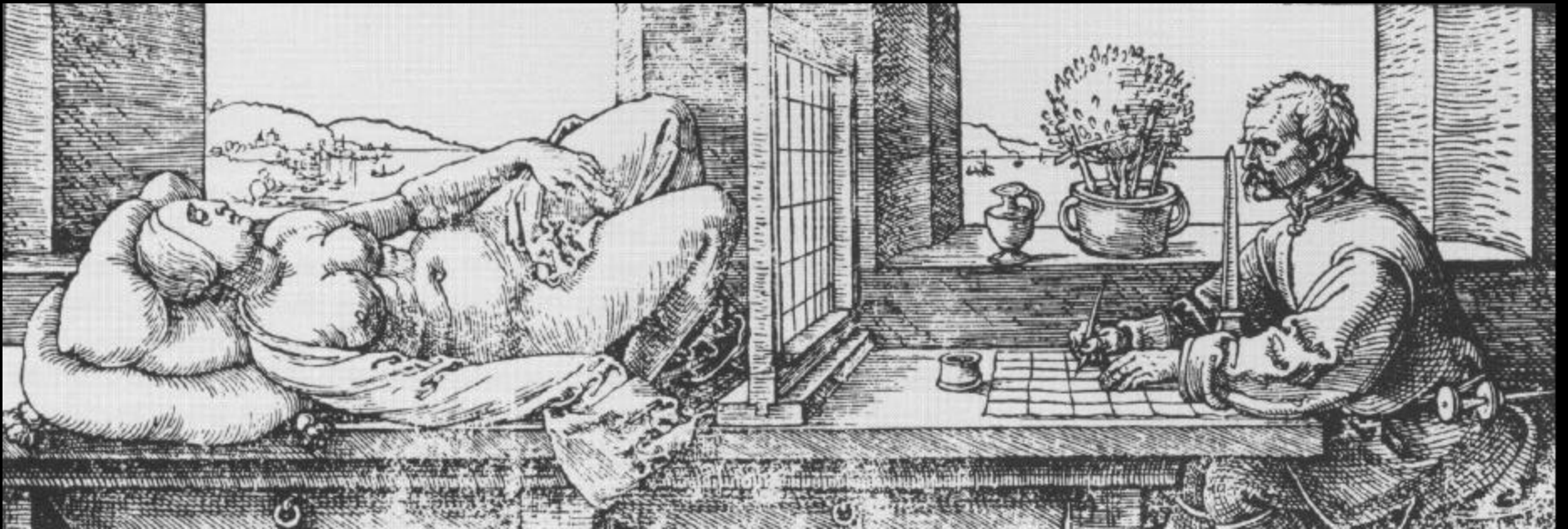
Dürer

- The artist's glass



Dürer

- The draftsman's net



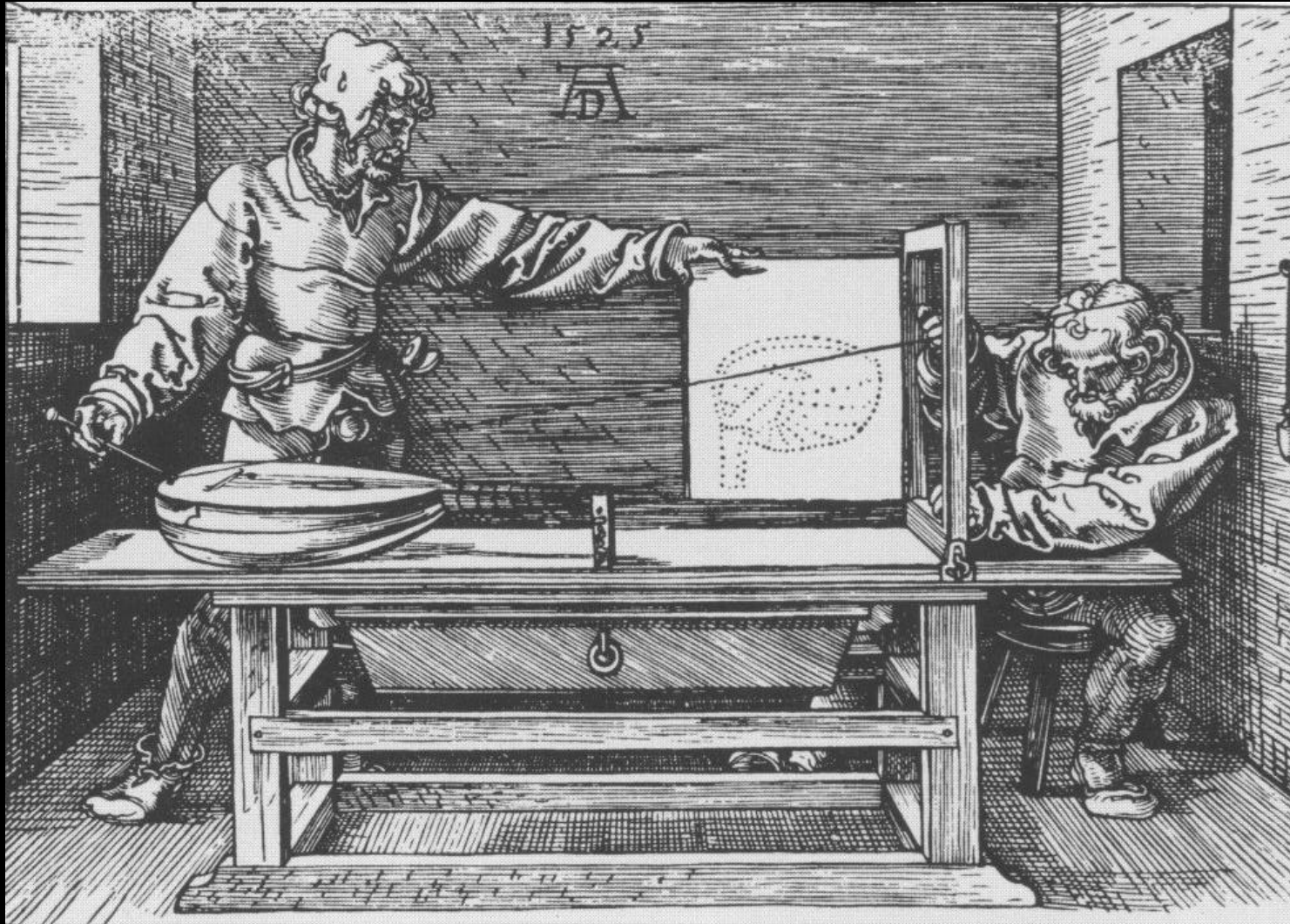
Dürer

- Jacob de Keyser's invention



Dürer

- Dürer's device



Conclusions about Renaissance

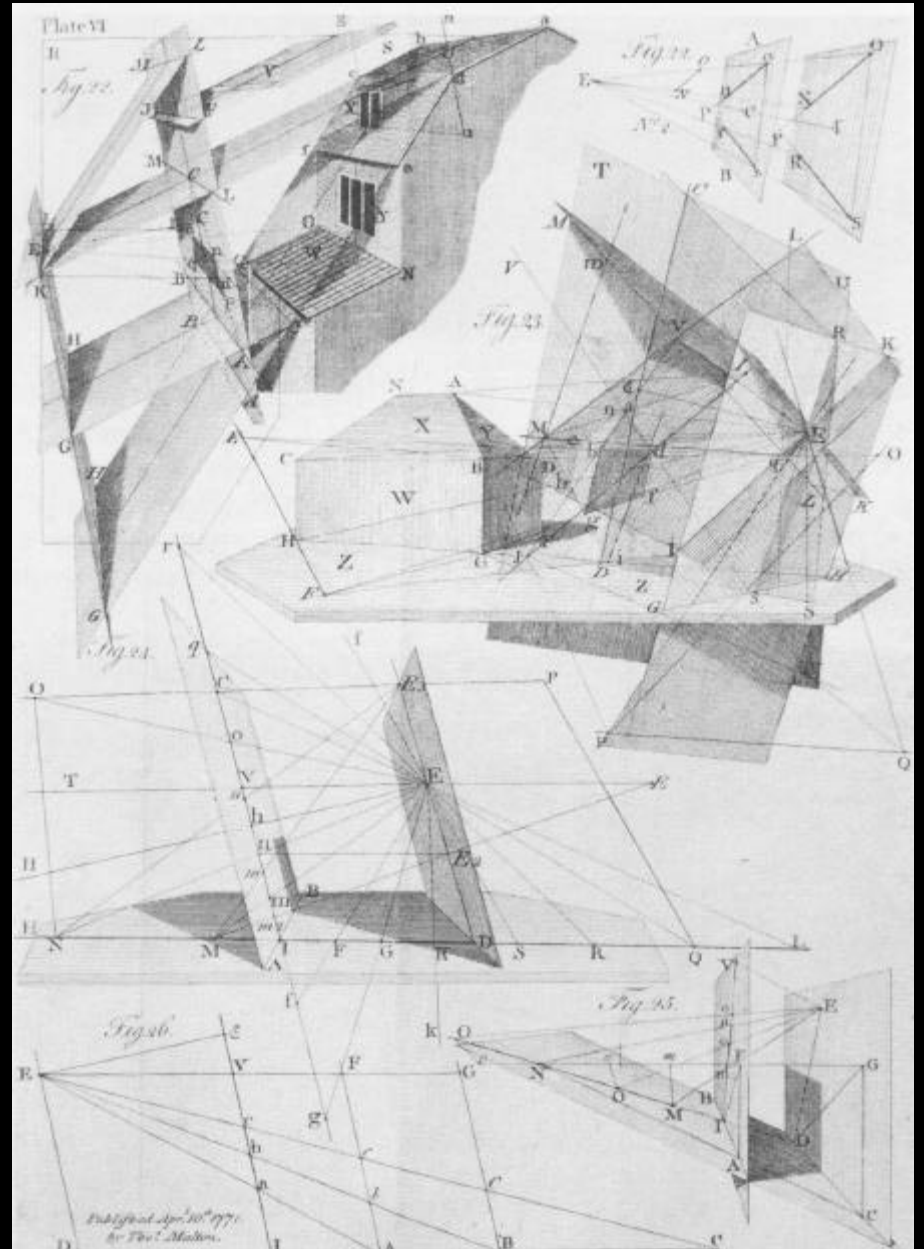
- Different techniques, refinement
- Measurement
- Mainly central perspective
- No notion of infinity, no vanishing point
- Spiritual notion of mathematical harmony

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*

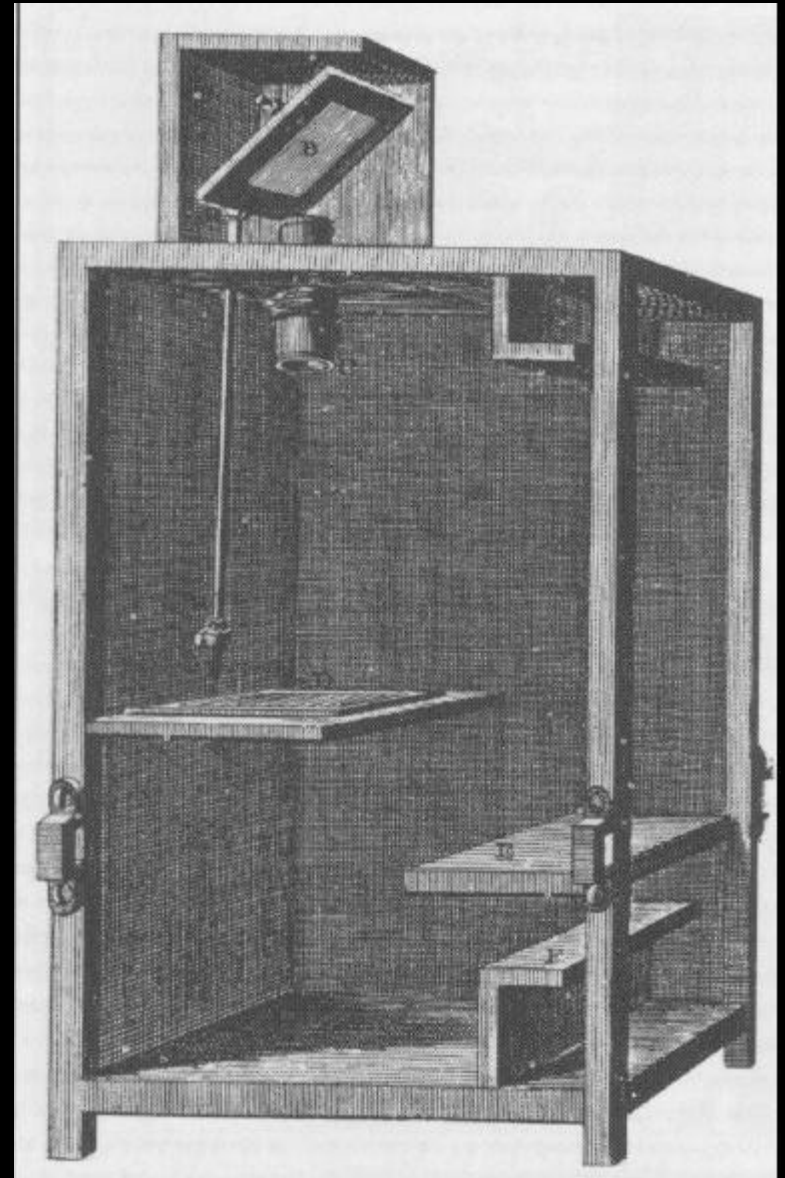


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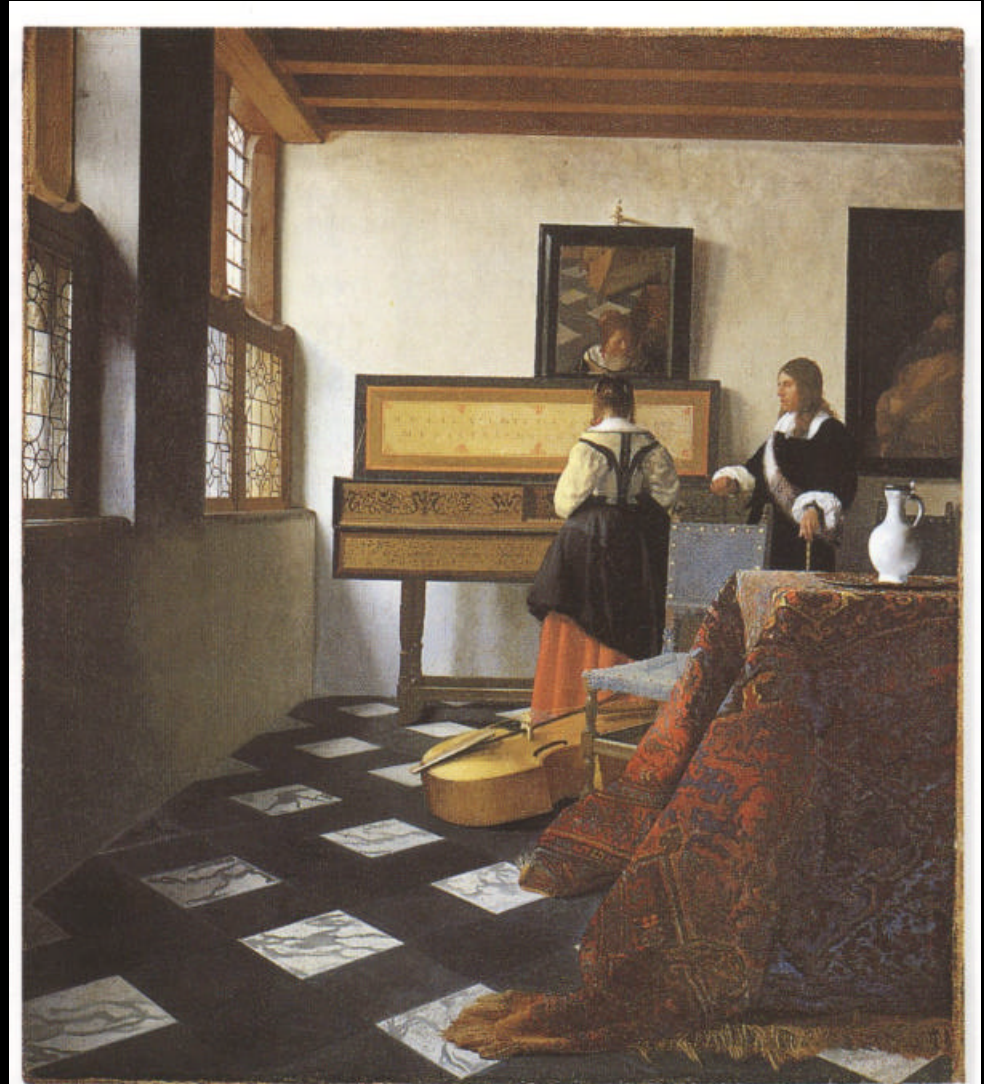
Gadgets

- Camera obscura



Vermeer 1660

- Camera obscura



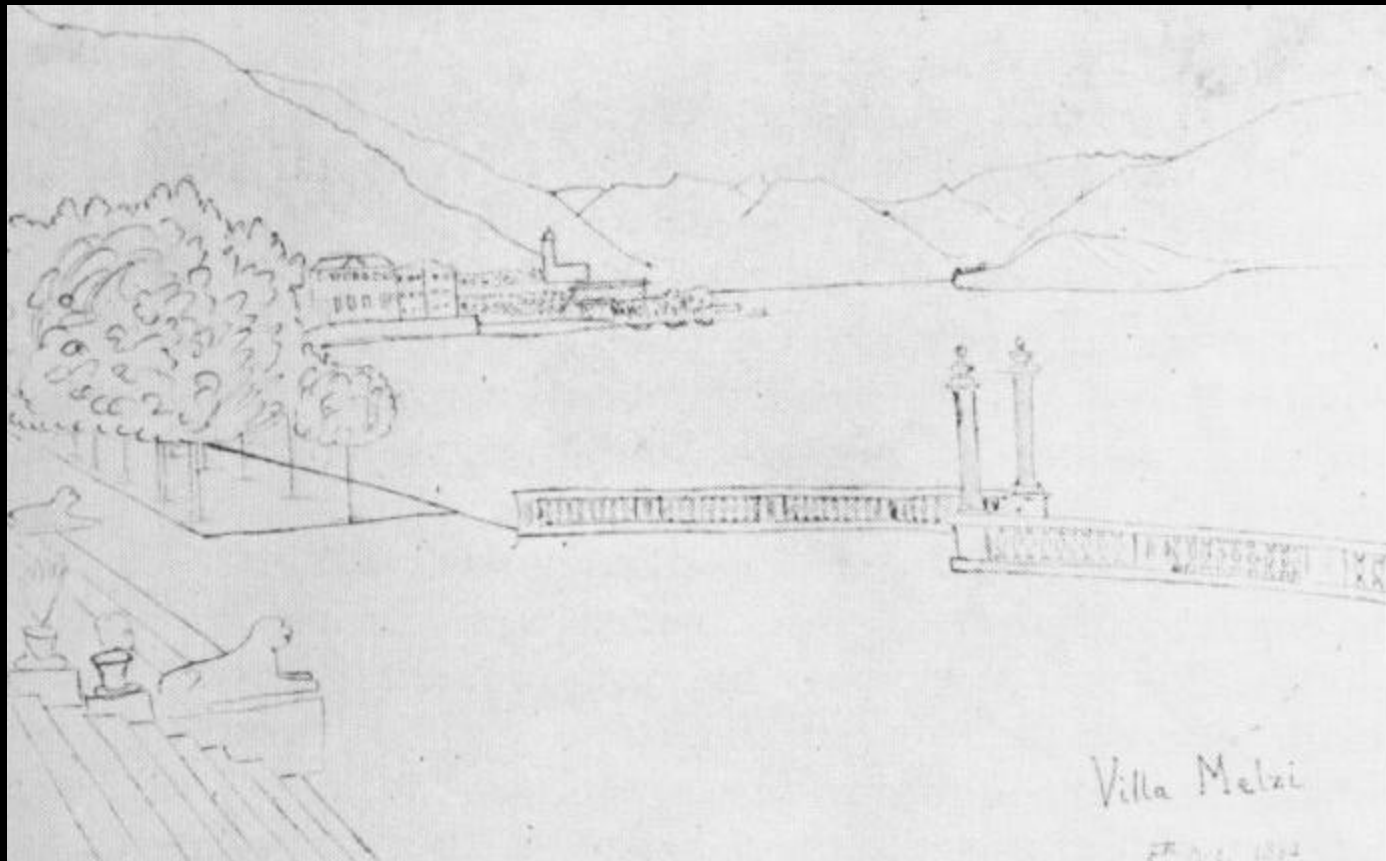
Gadgets

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



Gadgets

- Camera Lucida
- E.g. Talbot

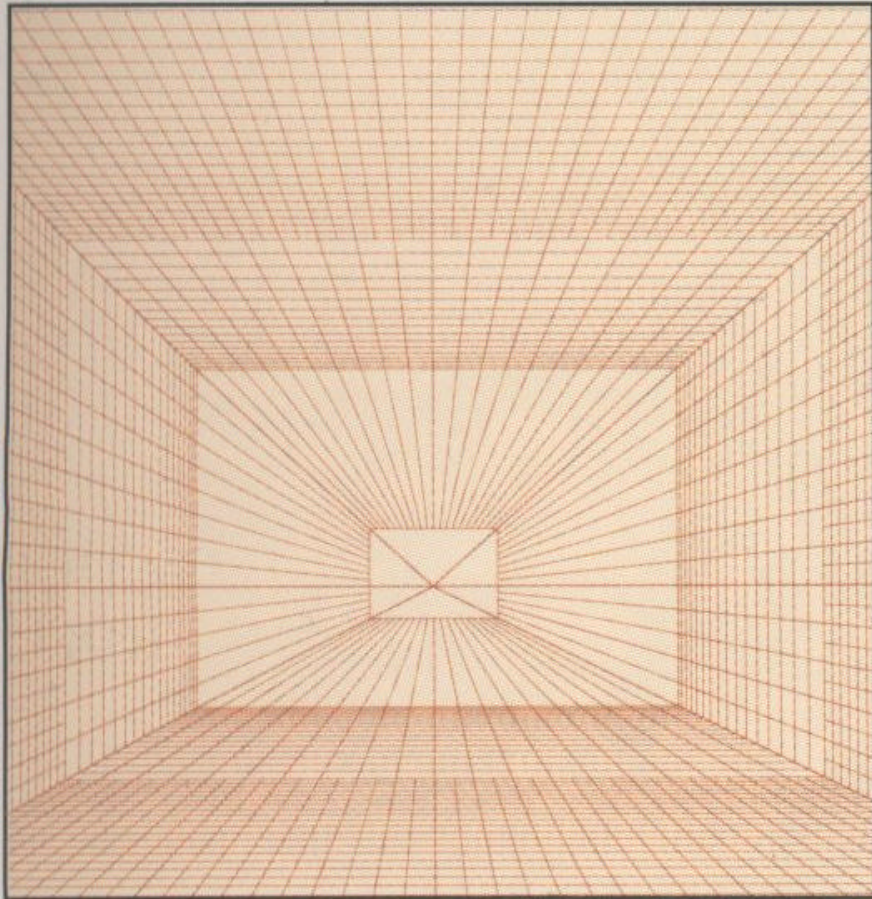


Perspective

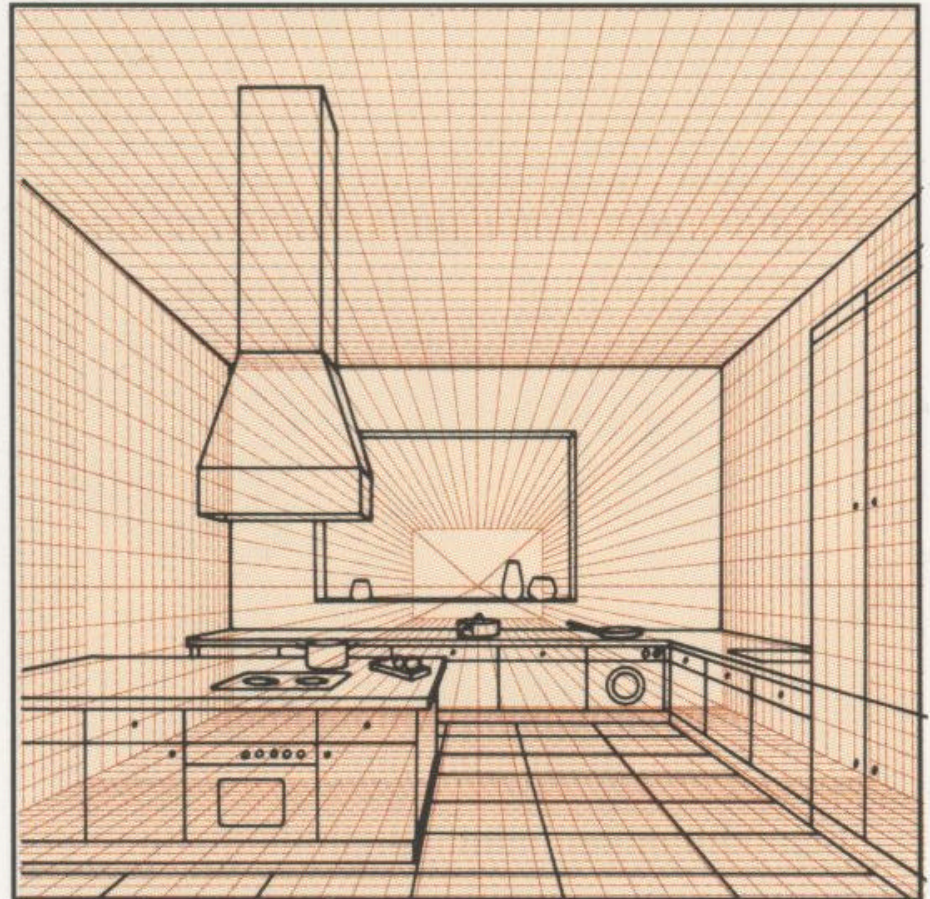


Perspective grids

42



43

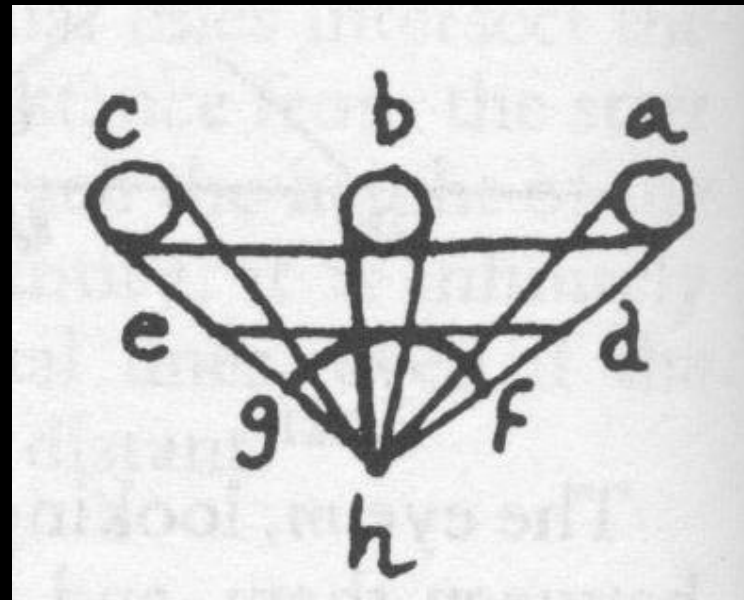
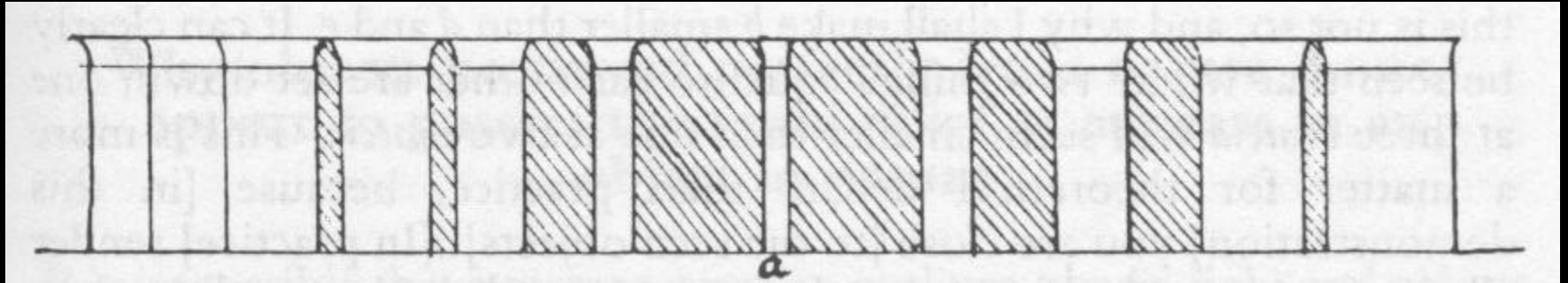


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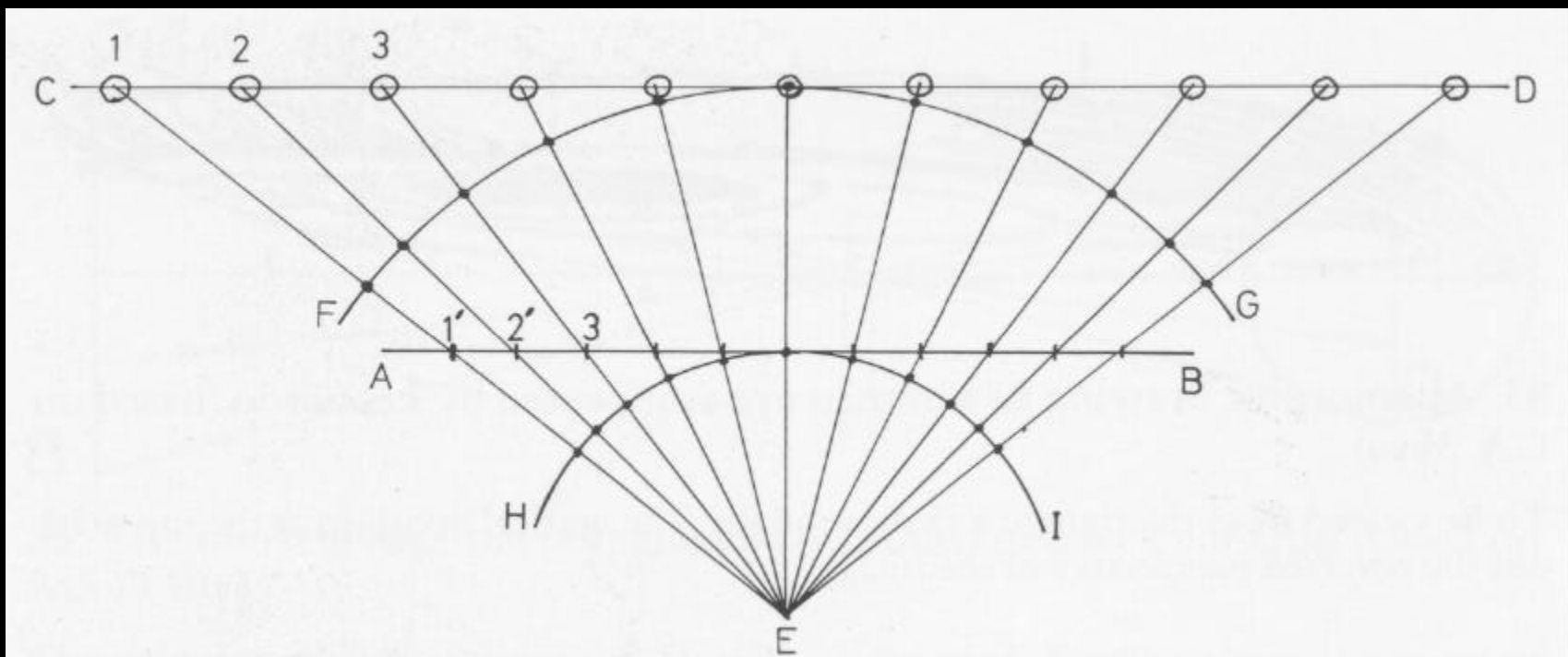
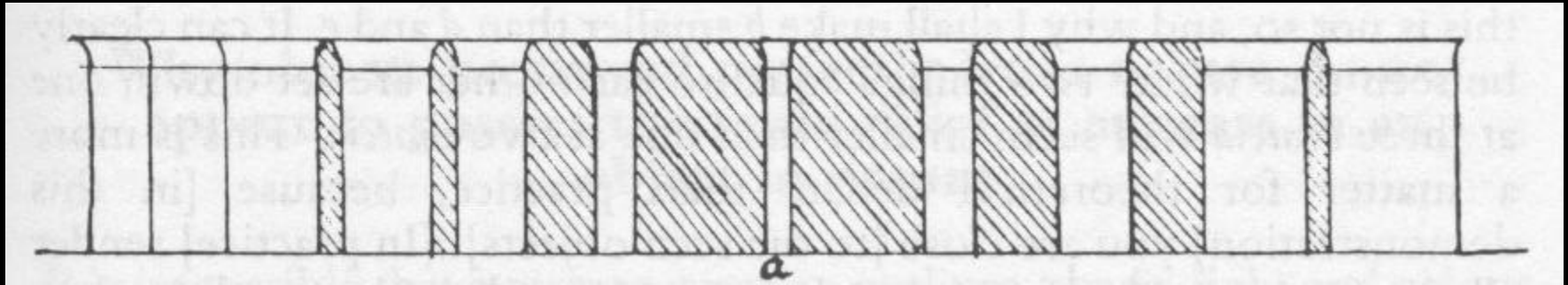
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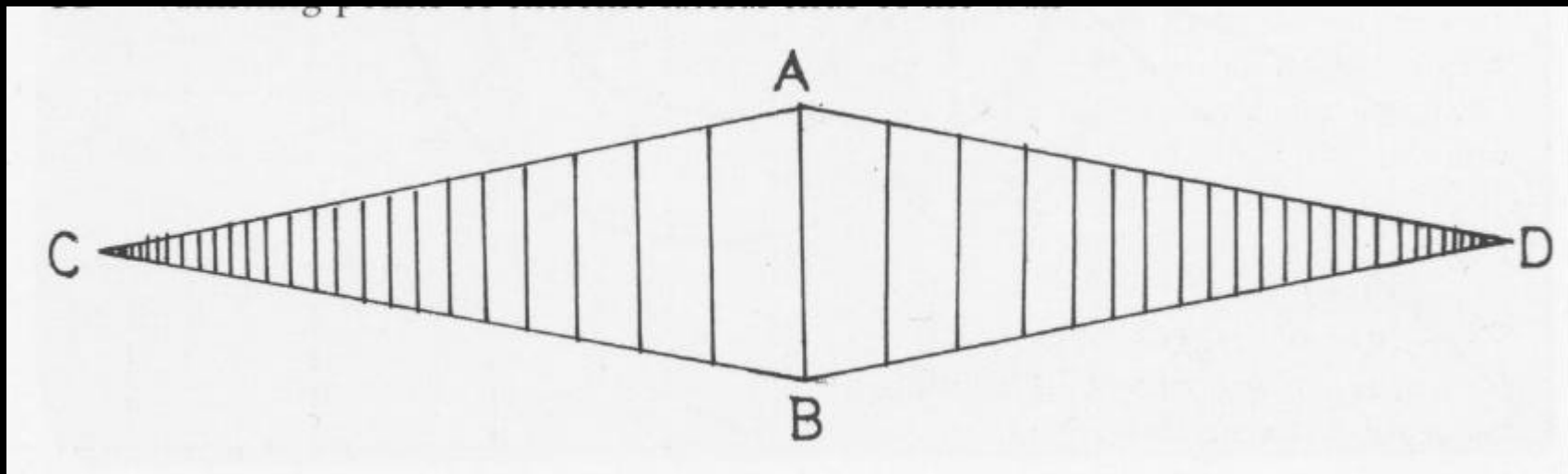
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Perspective distortion

- The sphere is projected as an ellipse



Perspective distortion

- The sphere is projected as an ellipse

