

# Perspective Drawing and Projective Geometry

Capstone  
WeiPing Li

The Renaissance was a cultural movement that profoundly affected European intellectual life in the early modern period (15<sup>th</sup> century).

Beginning in Italy, and spreading to the rest of Europe by the 16th century, its influence was felt in literature, philosophy, art, music, politics, science, religion, and other aspects of intellectual inquiry. Renaissance scholars employed the humanist method in study, and searched for realism and human emotion in art. Humanists asserted "the genius of man ... the unique and extraordinary ability of the human mind."

One of the distinguishing features of Renaissance art was its development of highly realistic linear perspective. Giotto di Bondone (1267–1337) is credited with first **treating a painting as a window into space**, but it was not until the demonstrations of architect Filippo Brunelleschi (1377–1446) and the subsequent writings of Leon Battista Alberti (1404–1472) that perspective was formalized as an artistic technique. **The development of perspective was part of a wider trend towards realism in the arts and reflecting the general world view of people connected to it.**

Painting not using Perspective Method:  
Initial word panel of Psalm



# Perspective method not used



# Perspective method not used



# Perspective method not used



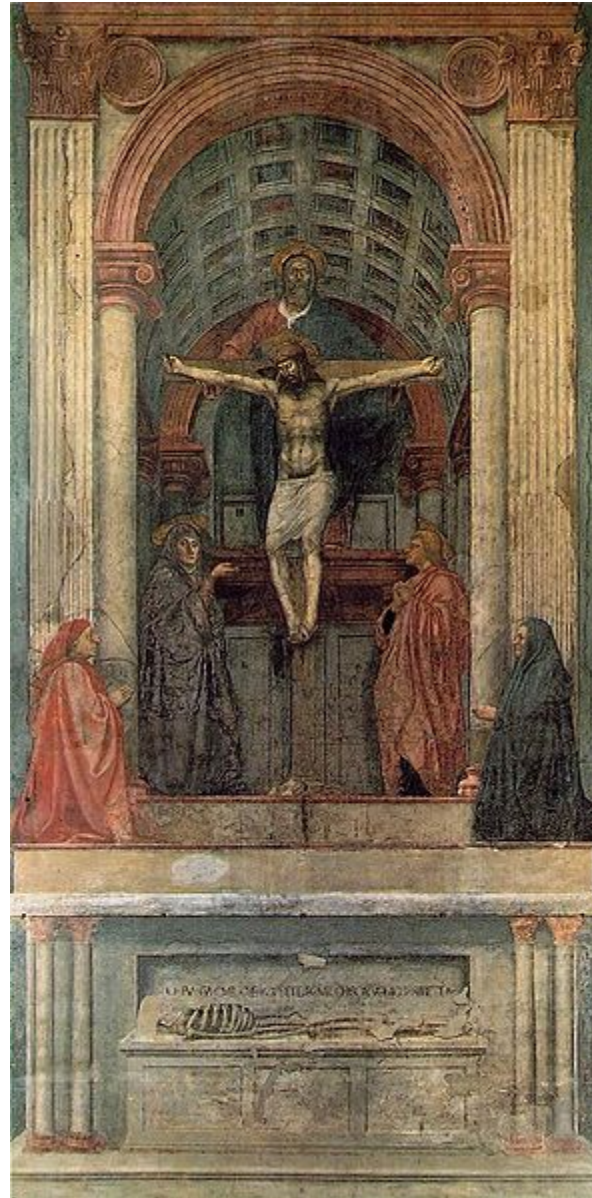


# Perspective method not used





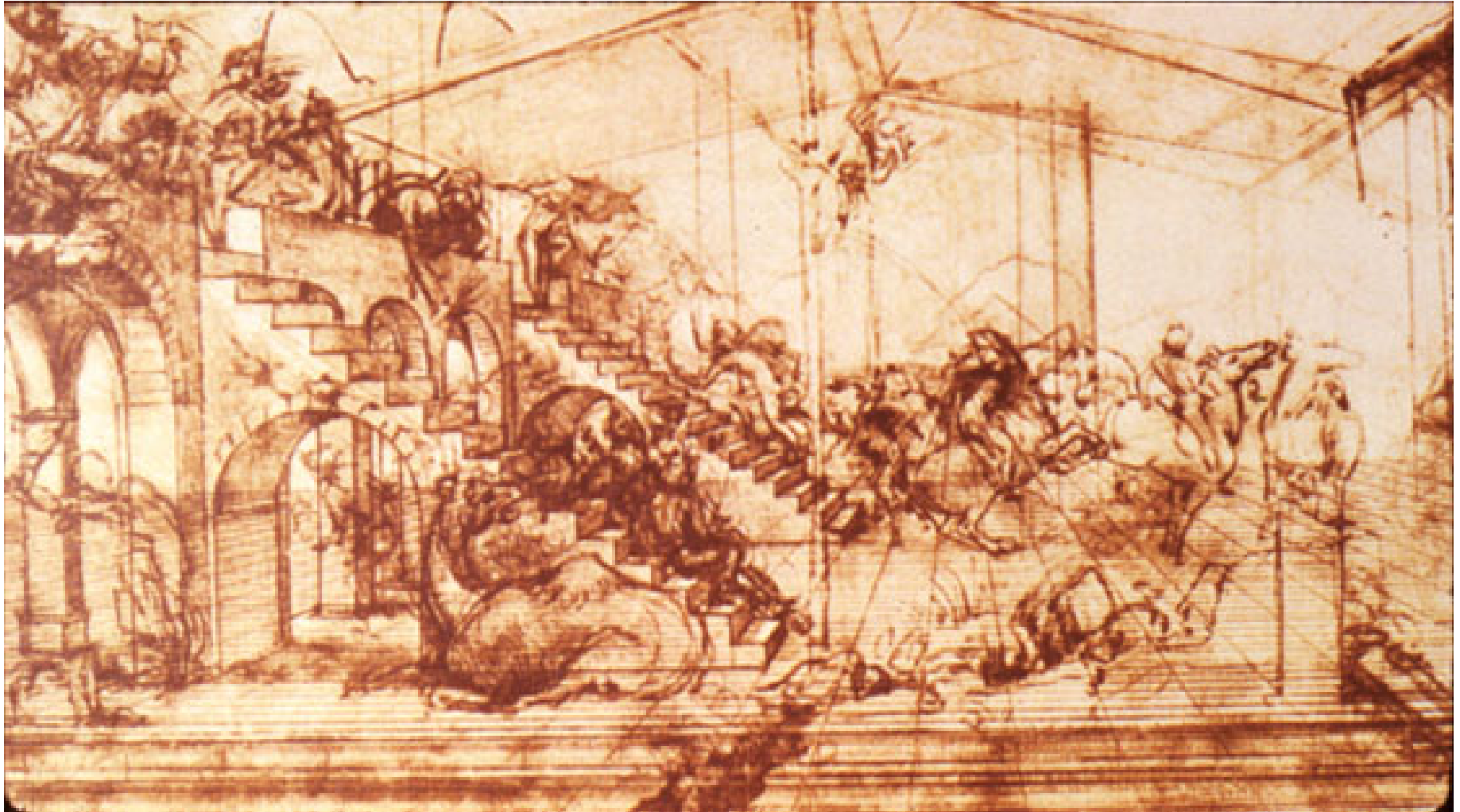
# Perspective method used: Masaccio, Trinity



# Perspective method used



# Perspective method used: Leonardo Da Vinci: Adoration (unfinished)



Perspective method used

## Donatello: St. George and the Dragon



Perspective method used

Donatello: The Feast of Herod





Perspective method used

Donatello: The Feast of Herod

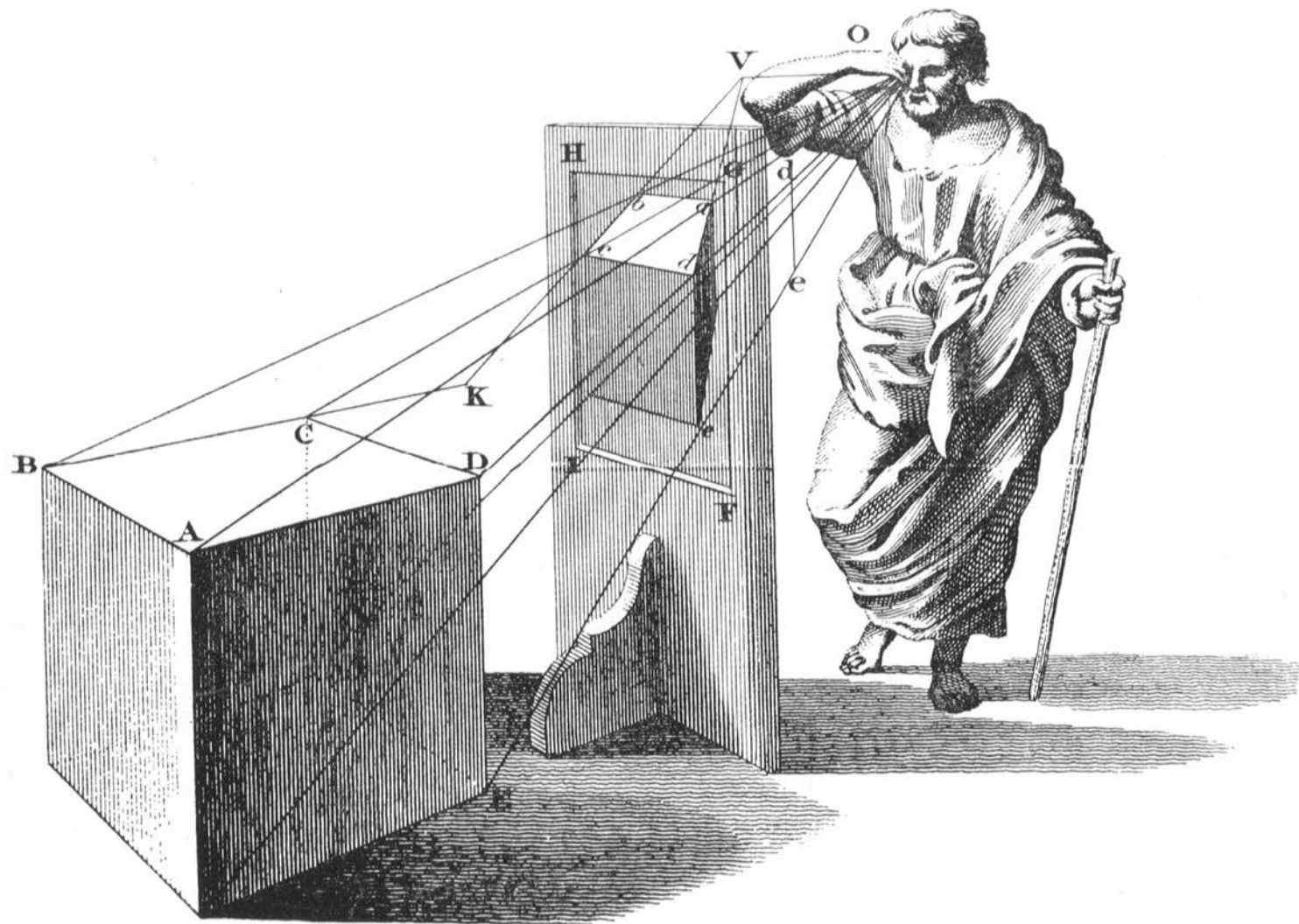


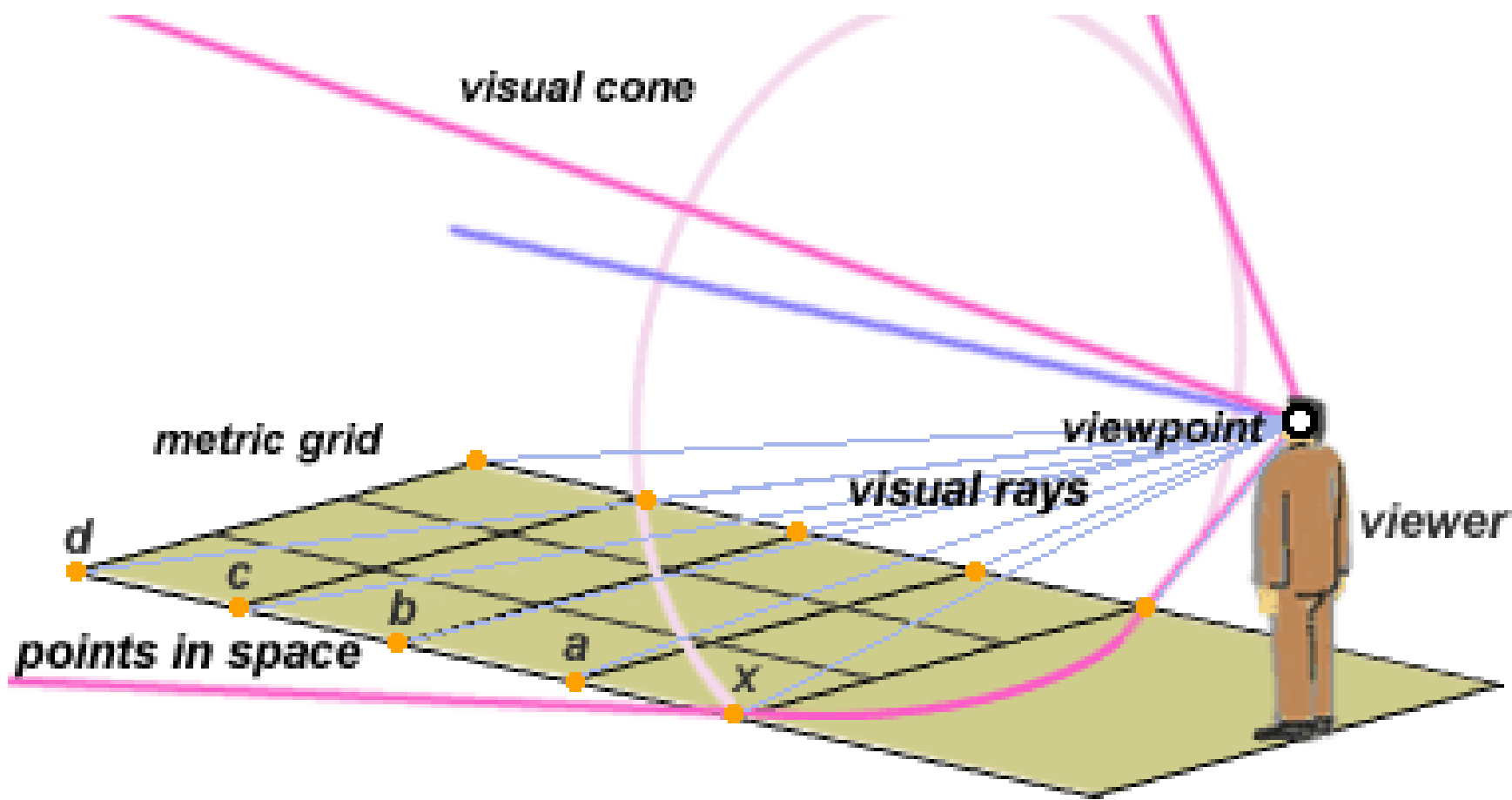
Artists such as Masaccio strove to portray the human form realistically, developing techniques to render perspective and light more naturally. Political philosophers, most famously Niccolò Machiavelli, sought to describe political life as it really was, and to improve government on the basis of reason.

The Renaissance could be viewed as an attempt by intellectuals to study and improve the secular and worldly, both through the revival of ideas from antiquity, and through novel approaches to thought.

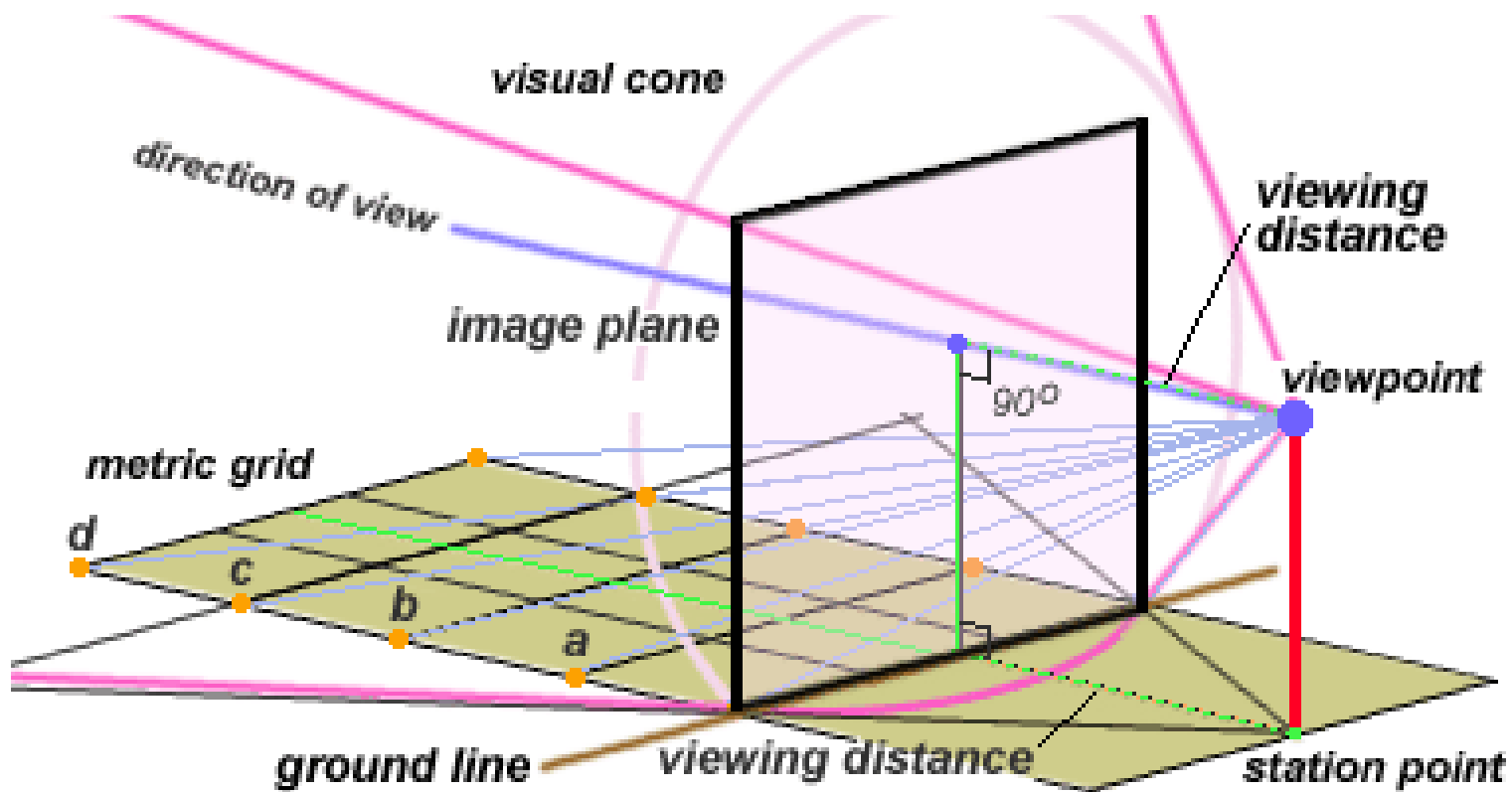
# Perspective Drawing

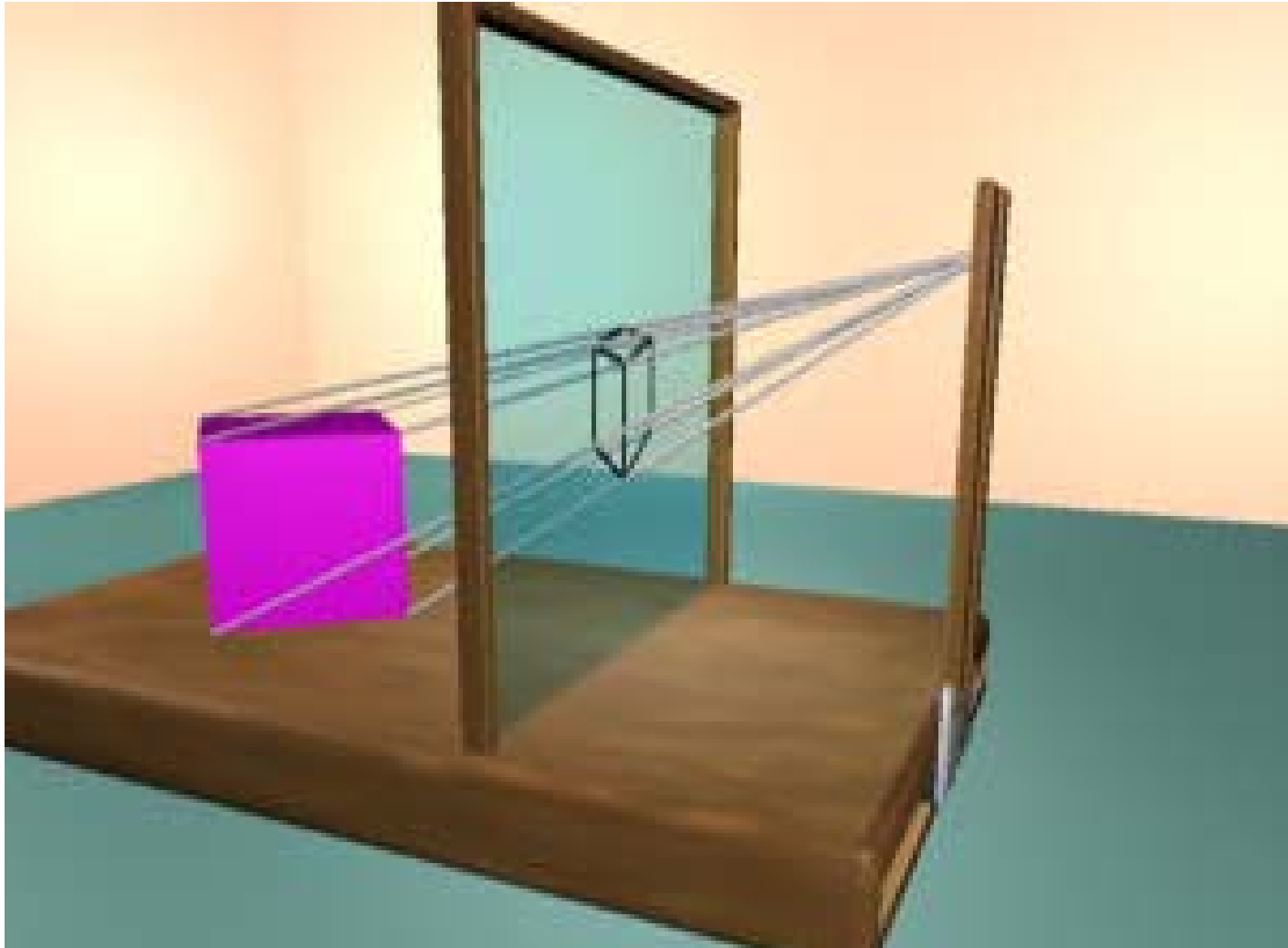
We think of the canvas as a glass screen. The light rays from the object pass through the screen arriving at viewer's eye to form an image. Perspective drawing is the section produced by the intersection of the glass screen with the light rays.











## People

Brunelleschi (1377-1446):discovered/invented perspective drawing

Brunelleschi 's friends were the forerunners :

Masaccio (1401 -1428)

Masolino (1384-1447)

Donatello (1386-1466)

Alberti (1404-1472) published Della Pittura to popularize method of perspective drawing.

# Bronze statue of Filippo Brunelleschi



# Brunelleschi: Santa Maria della Fiore, the Duomo, the Baptistry





# Leon Battista Alberti (1404—1474)



# Della Pittura

LA PITTURA  
DI LEONBATTISTA  
ALBERTI TRADOTTA  
PER M. LODOVICO  
DOMENICHI.



*Con Gratia & Privilegio.*

E T E R N A

D E L A M I A M O R T E

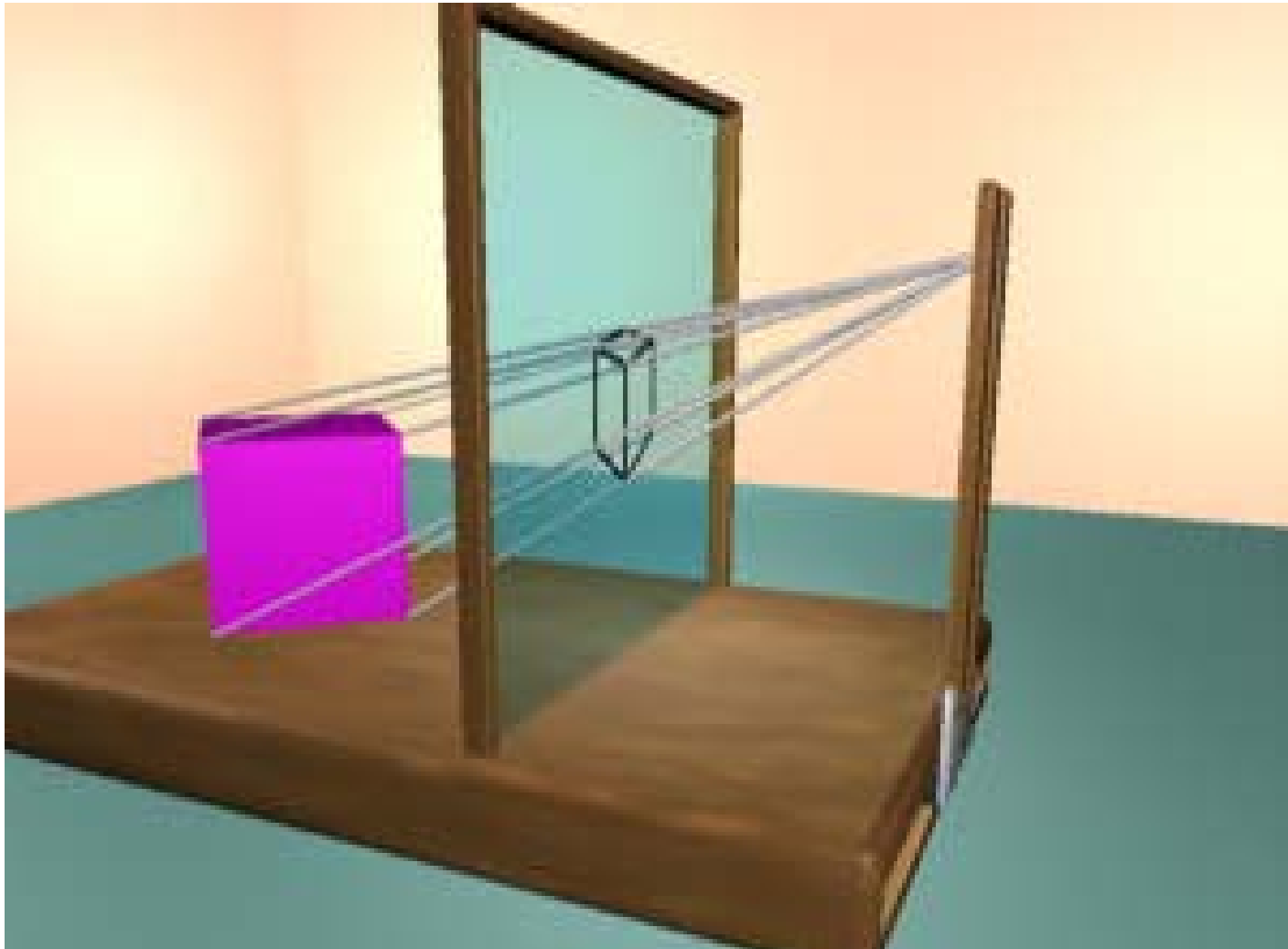


V I V I A

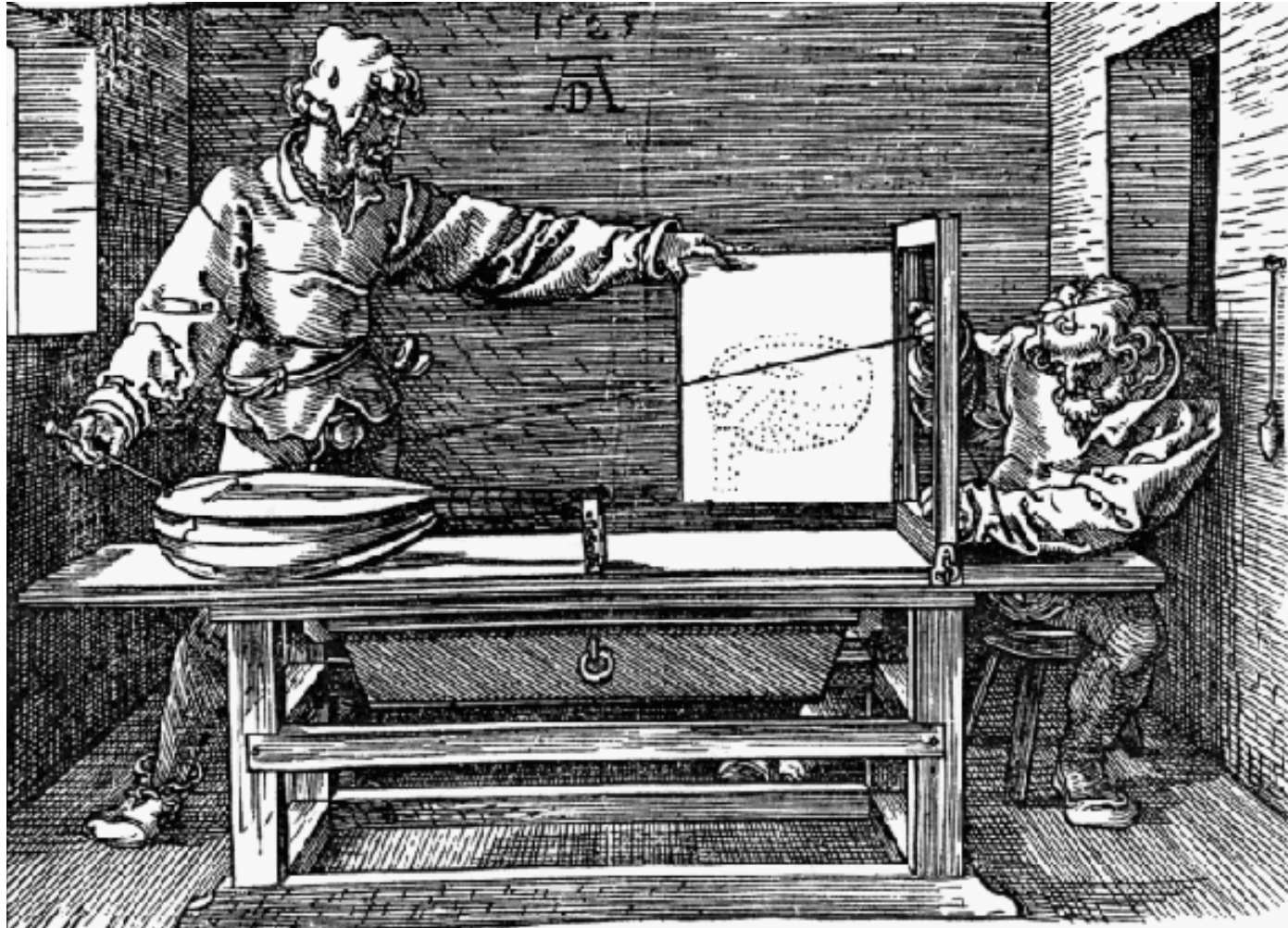
*In Vinegia Appresso Gabriel  
Giolito de Ferrari.*  
M D X L V I I.

*Di Orazio Nicolai f<sup>co</sup>*

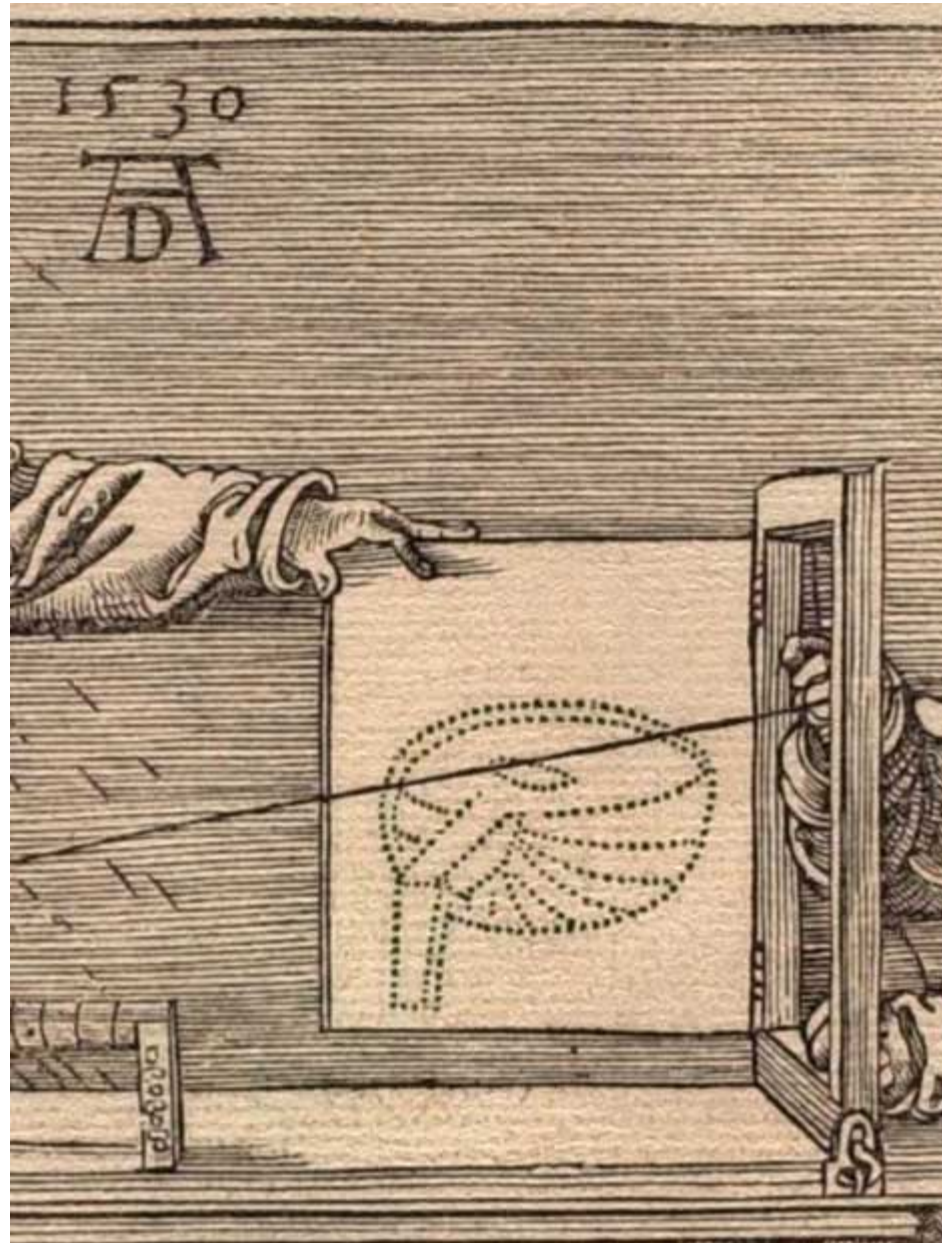
The method of perspective drawing is developed from geometric principles in projecting 3-dim object onto 2-dim plane.



# Dürer perspective drawing device





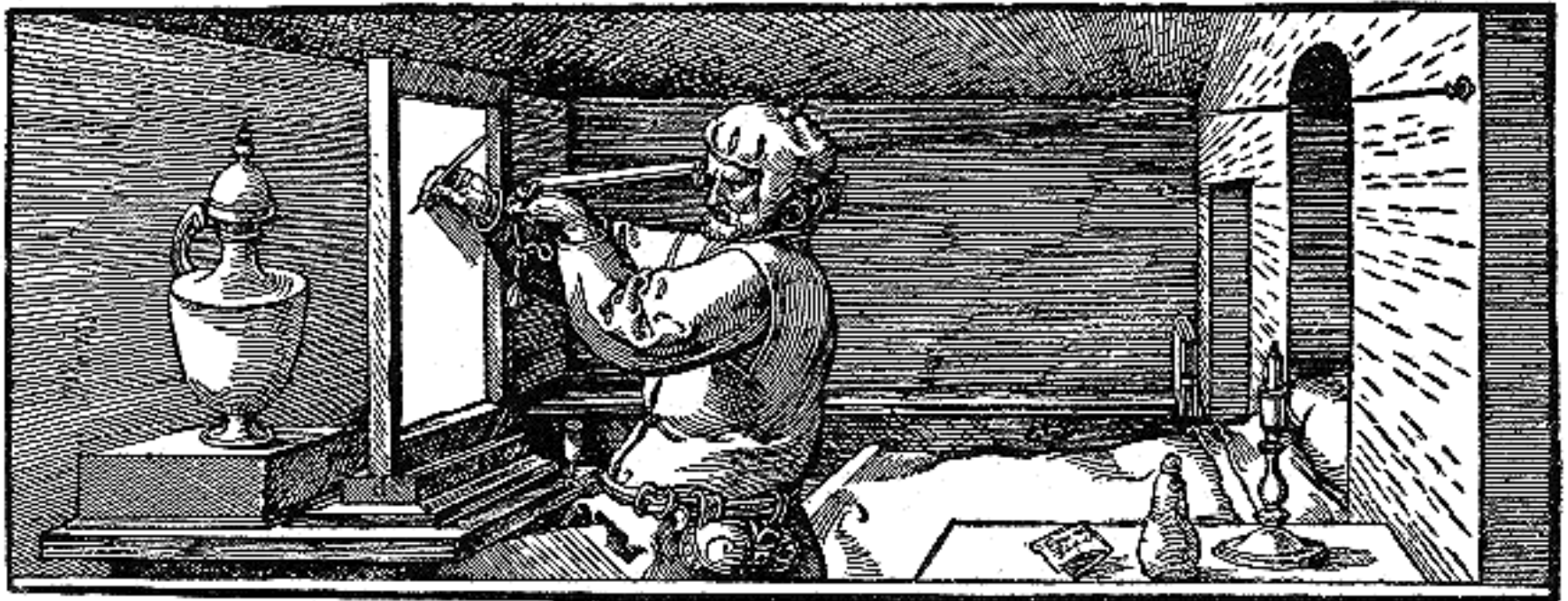




# Dürer perspective drawing device



# Dürer perspective drawing device







**Erwin Panofsky:** Perspective method translates psychophysiological space into mathematical space. It objectivizes the subjective.

Why did people in Renaissance embrace perspective method?

# Religion

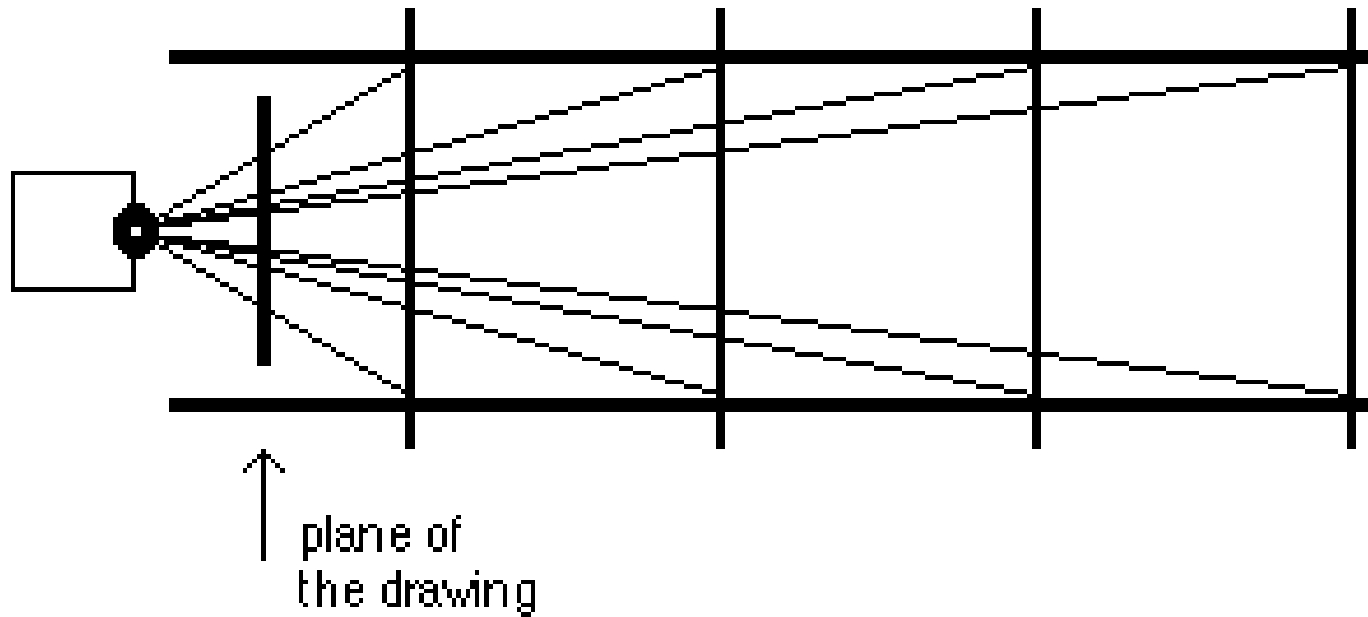
- Roger Bacon (1220-1292) thought that following geometric principles was to spread the grace of god.
- Renaissance painters thought that linear perspective could help to re-establish the moral authority of the church.
- Alberti had the conviction that the beauties of the arts correspond to a moral and spiritual equilibrium of human existence.
- Linear perspective, with its dependence on geometric principles, seemed to symbolize a harmonious relationship between mathematical tidiness and God's will.

# Economics, Education

- Because of the development of banking, many schools in Florence taught basic algebra and bookkeeping.
- In bookkeeping, numerals have to be arranged in order. This practice made Florence citizens to think that the visual world could also be arranged in an orderly way.
- Renaissance artists all mastered mathematics.

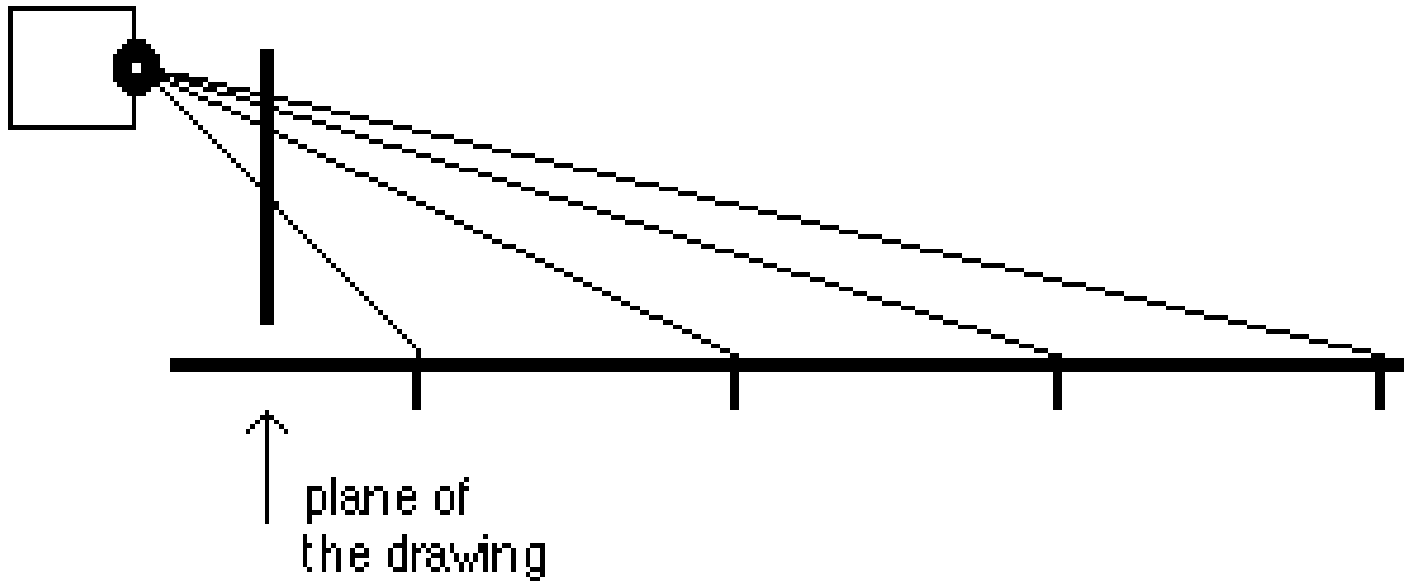
# Vanishing point

View from above



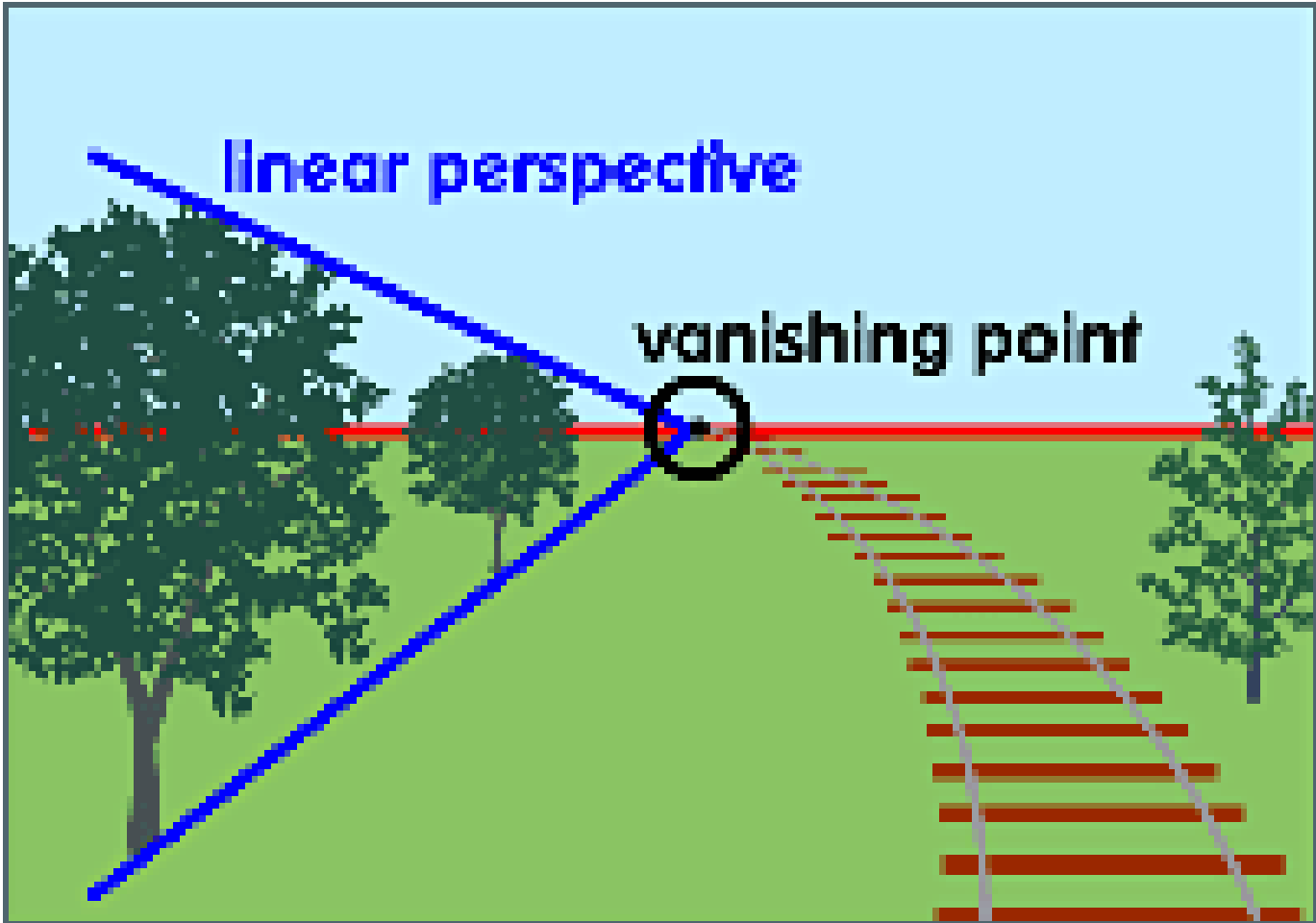
# Vanishing point

Side View





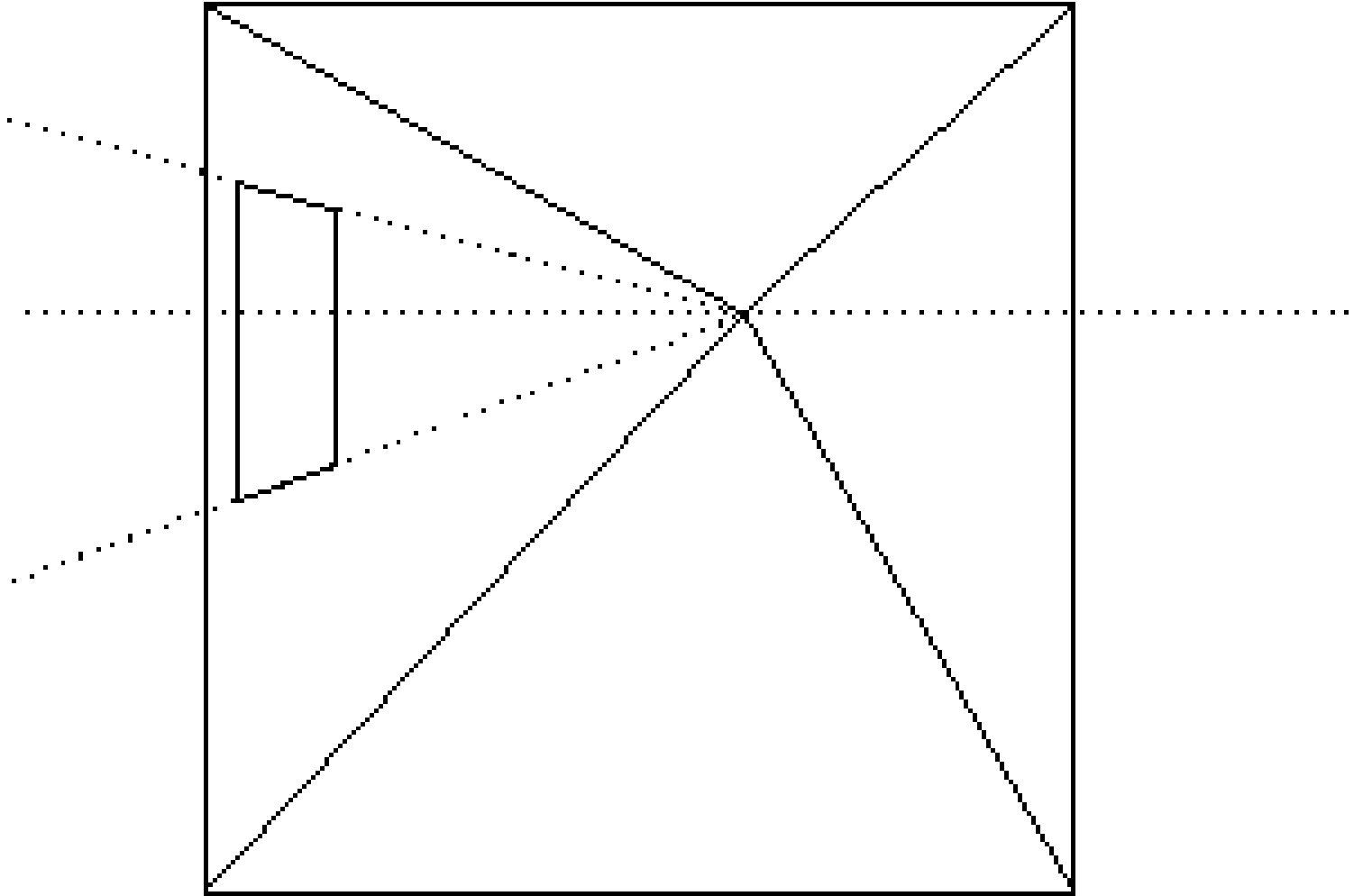
In perspective drawing, for parallel lines that meet the canvas, its rendering will meet at one point in the canvas called the vanishing point. All vanishing points form a straight line called the horizon in the painting.

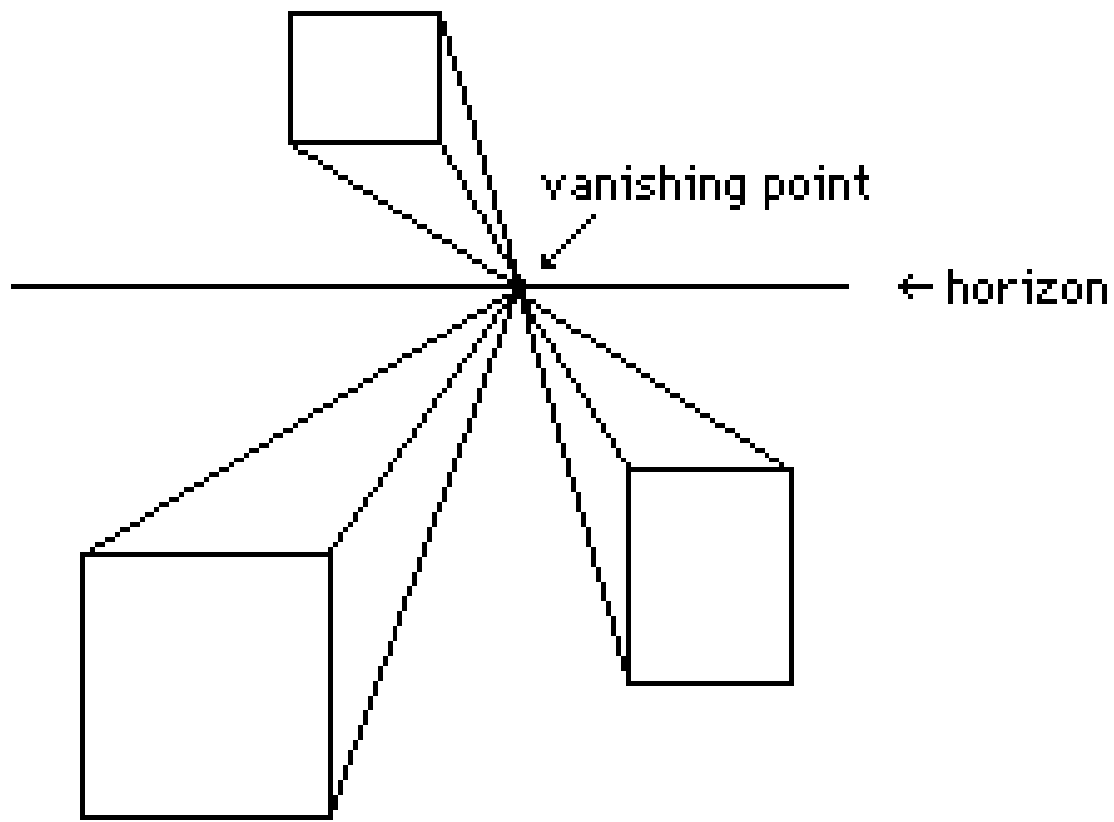


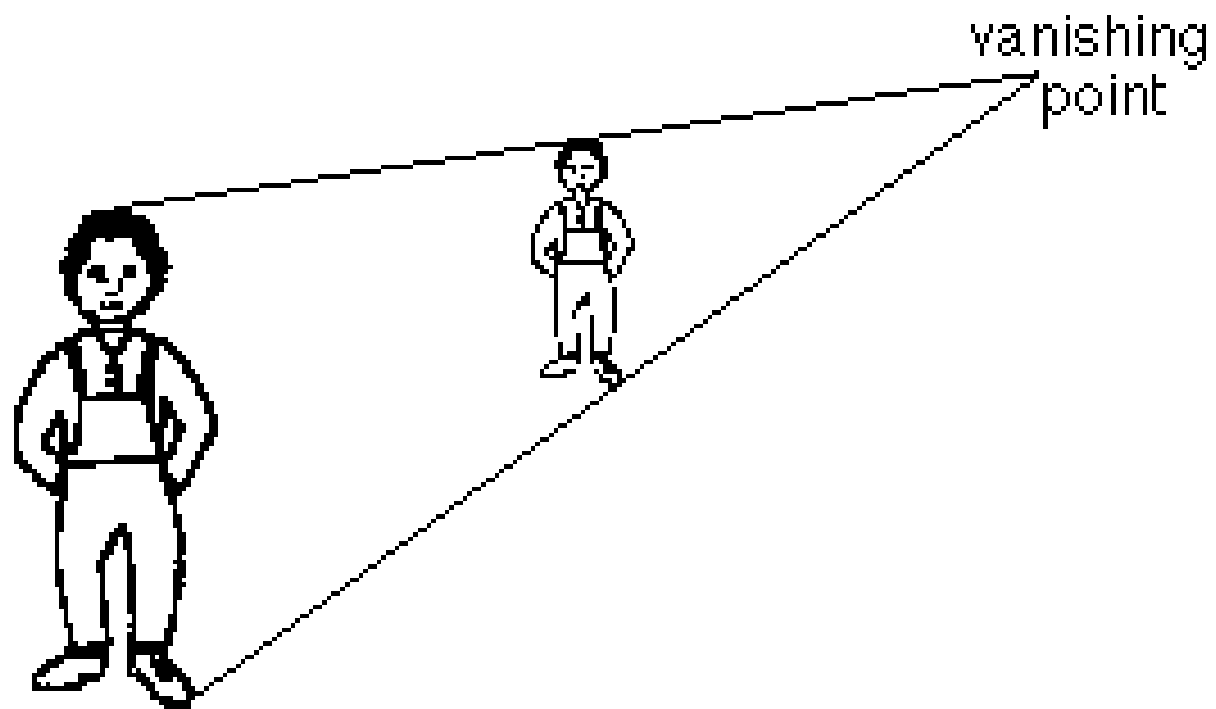
linear perspective

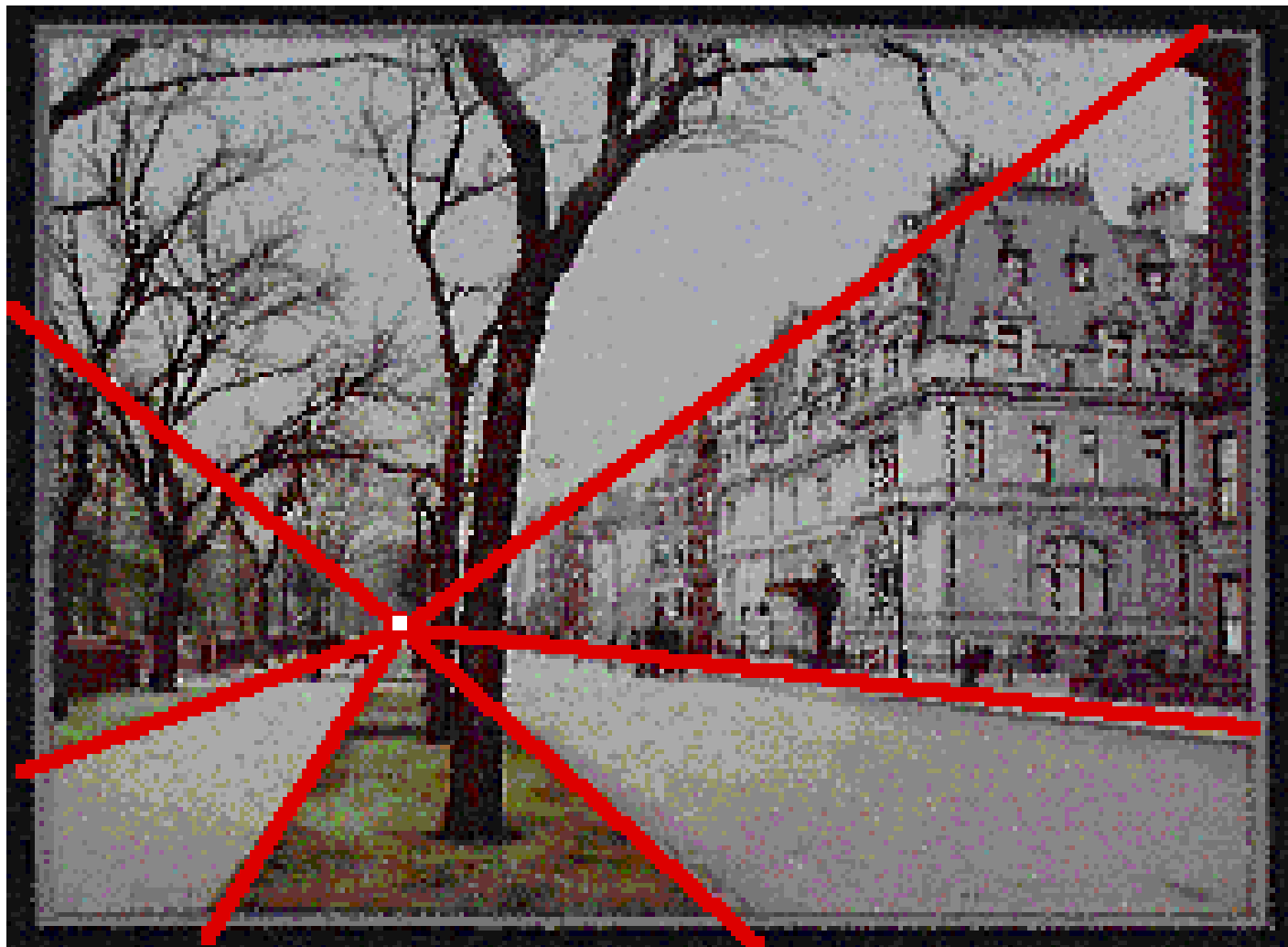
vanishing point

horizon line









# Ancient Angora, Athens



The Renaissance painters use the vanishing point as a narrative tool in guiding observers' attention to the important part of the painting.



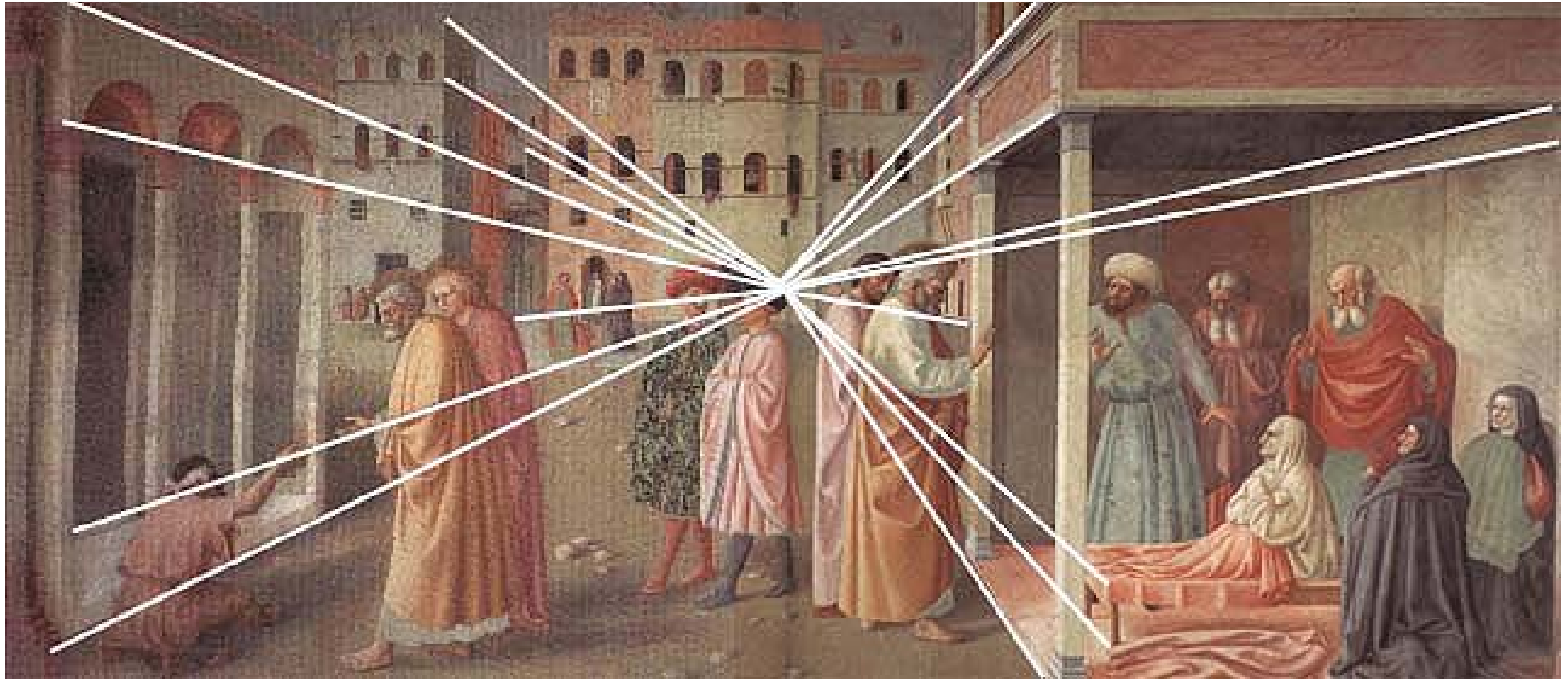
## Masaccio: Tribute Money



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## Masolino: Healing of the Cripple and Rising of Tahitha



# Neruccio de'Landi: Annunciation



# Neroccio de' Landi: Annunciation



# Da Vinci: The Last Supper



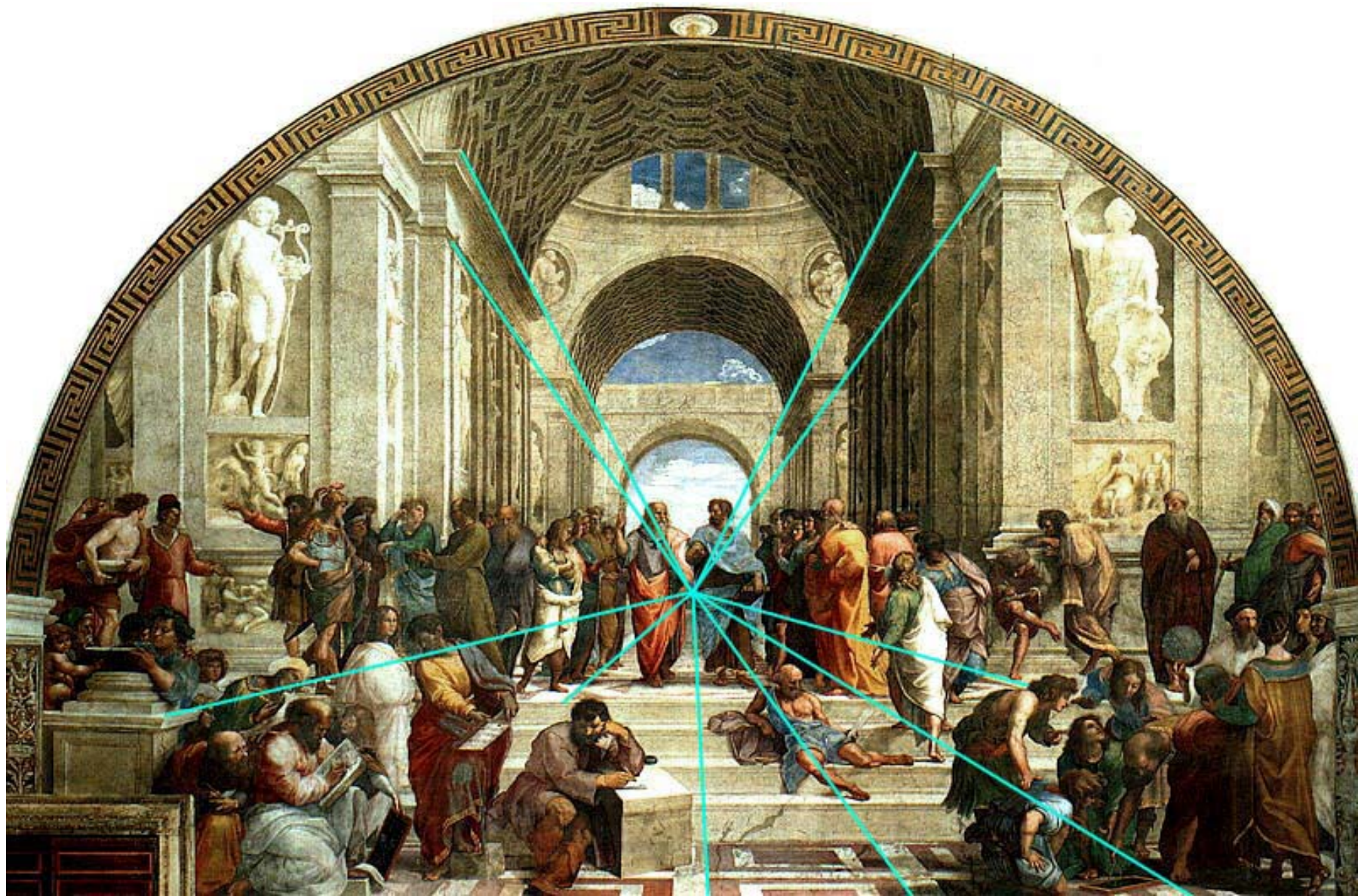
# Da Vinci: The Last Supper



# Da Vinci: The Annunciation





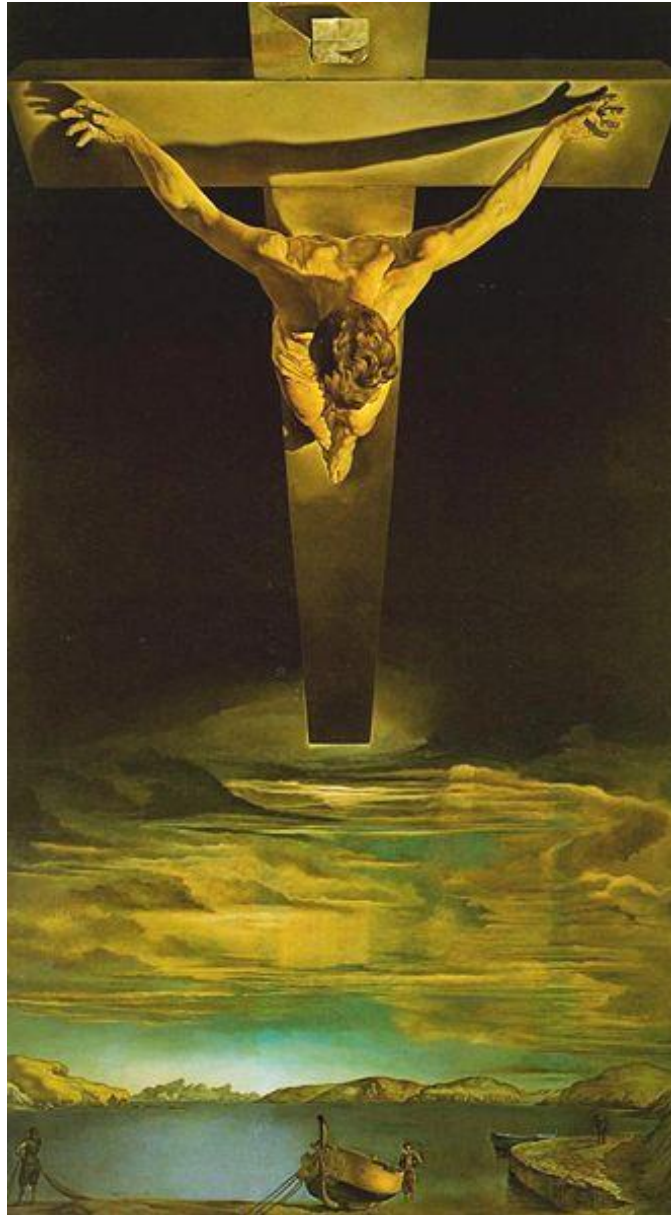




# Carpaccio: The Disputation of St. Stephen

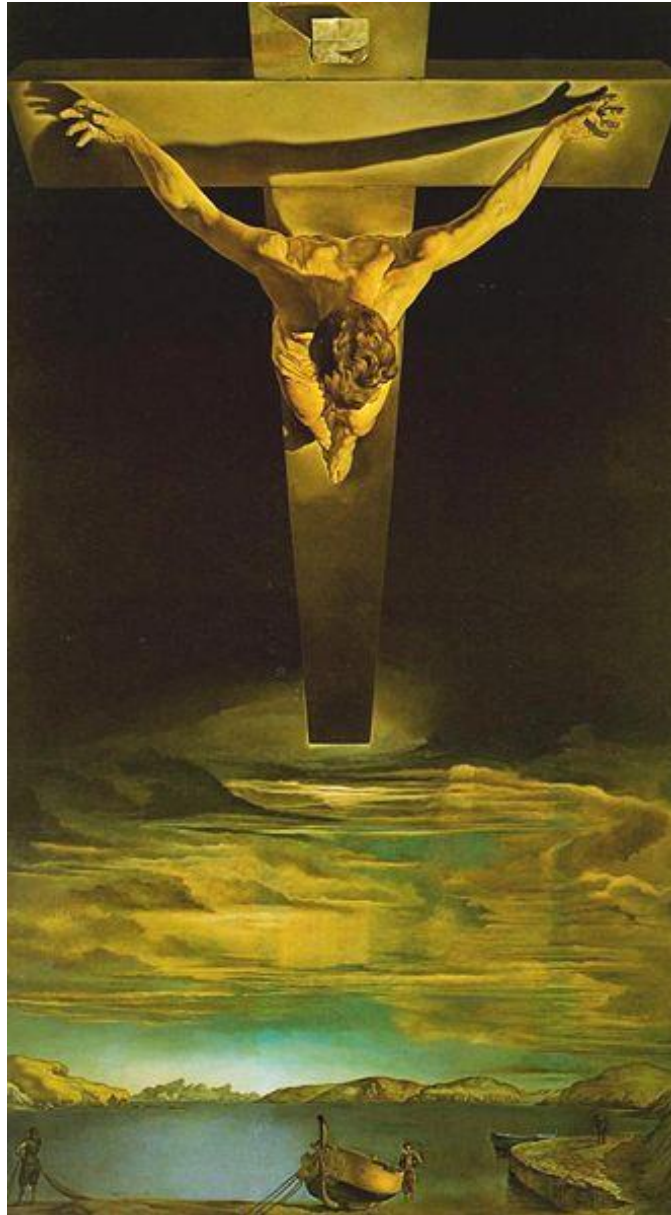


# Dali: Christ of St John of the Cross





# Dali: Christ of St John of the Cross



# Projective Geometry

Desargues (1591-1661):

Perspective drawing method  
inspired the development of  
Projective Geometry.

# Family of parallel lines

## Real Projective Plane :

To every family of parallel lines an ideal point at infinity is added to represent the intersection of the family of parallel line at “infinity”. All the ideal points form a “line at infinity”.



In perspective drawing, the “horizon” is the “line at infinity” in projective geometry.

For an painter,

- \* perspective image of a straight line is a straight line
- \* parallel lines that are parallel to the canvas, their perspective images are parallel lines on the canvas.
- \* parallel line that are not parallel to the canvas will meet at a vanishing point on the canvas.
- \* vanishing points form the line of horizon.

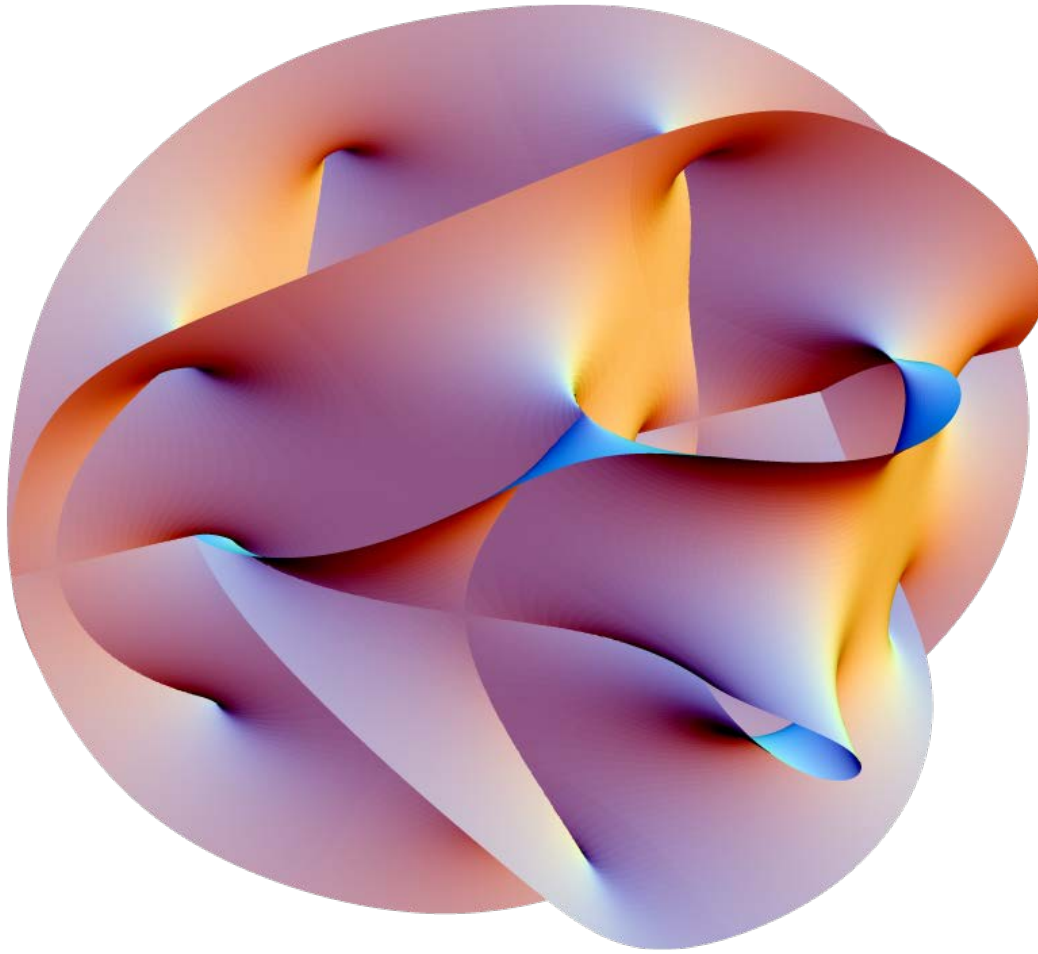
# (Real) Projective Geometry

The Projective Plane is obtained from the Euclidean plane by adding the points at infinity and the line at infinity that is formed by all the points at infinity. In this geometry, any two lines will meet at one point. The (real) projective plane can also be obtained from an algebraic construction. If we use complex numbers in this construction, we get the complex projective spaces. Complex projective spaces have much nicer properties. For example, the Calabi-Yau Universe is a 3-dimensional complex manifold in the 4-dimensional complex projective space.

# Projective plane (real)



# Calabi-Yau universe



# Desargues Theorem

