A mathematicians view of a painting by

Carlo Crivelli 1486:

Annunciation with St. Emidius

(Now: London National Gallery)

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(TU Darmstadt)

January 25, 2010   Kyoto

Thanks to my colleague, Karl Heinrich Hofmann, who provided the material for this talk.

K. H. Hofmann:
Angewandte Mathematik in der Rennaissance
Crivellis Verkündigung mit St. Emidius
Mitteilungen der DMV 4 (2000), 26–33

N. Heldermann, K.H. Hofmann, R. Münder
Hin und her zwischen den Dimensionen
Ein Modell zur Perspektive und Bildbeschreibung
Mitteilungen der DMV 16 (2008), 246–250

The painter

Carlo Crivelli

born between 1430 and 1435 in Venice

died just before 1500 in Ascoli (?)
the town for which our painting was produced.

Crivelli learned his art of painting probably in Parma. He lived for some time in Venice and had some adventures: He kidnapped the wife of a sailor (Francesco Cortese) and kept her in his house for several months. For this he was sentenced to prison in Venice in 1457. After that he left Italy fo several years and returned about ten years later to the region around Ascoli, a small town in the middle of Italy of about 50 000 inhabitants nowadays.

Aspects of a Painting

– Form

– Contents

– Purpose

How to teach the Bible

Prediche de frate Roberto vulgare no-
uaméte hystoriate τ corepte secúdo
li Euangelii che se contengono
in le ditte prediche.

Function of pictorial representations

Johannes de Genoa, late 13th century:

You should know that there are three reasons for the showing of pictures in churches:

Firstly, for the instruction of simple folk, because they are taught through pictures as if they were books.

Secondly, in order to let the mystery of incarnation and the example of the saints have an even stronger effect on our memory through their daily presence before our eyes.

Thirdly, in order to evoke the feelings of religeous dedication which are awakened more easily by that which we see than by that which we hear.

The special purpose

The town of Ascoli was under papal rule and in 1482 Pope Sixtus VI granted it a degree of self-government.

The news reached the city on March 25, the day on which the church every year celebrates the Annunciation, which then became a special feast day, when the town celebrates its liberty. The altarpiece was painted for the church of SS Annunciata in Ascoli to celebrate this event.

The coats of arms are those of the pope (on the left) and of the local bishop, Prospero Cafarelli (to the right). Also included in the picture is St. Emidius, the Patron Saint of the town of Ascoli, holding a model of the town. Ascoli is dominated by towers and it seems it is still recognizable today in the model on the painting.

The two parts of the Bible

The Old Testament (common with the Jewish religion): Contains the history of the Jewish nation and its faith in ONE God.

The New Testament: About the life, the teaching and the mission of Jesus Christ.

The 'Annunciation' takes place just at the transition from the Old to the New Testament in the year 0 b.C.: The angel Gabriel announces to the virgin Mary that she will conceive a son in the following wording:

From the bible: Luke 1, 26 - 38

And in the sixth month the angel Gabriel was sent from God unto a city of Galilee, named Nazareth,

To a virgin espoused to a man whose name was Joseph, of the house of David; and the virgins name was Mary.

And the angel came in unto her, and said, Hail, thou that art highly favoured, the Lord is with thee; blessed art thou among women.

And the angel said to her, Fear not, Mary: for thou hast found favour with God.

And, behold, thou shalt conceive in thy womb, and bring forth a son, and shall call his name JESUS.

From the bible: Luke 1, 26 - 38

He shall be great, and shall be called the Son of the Highest: and the Lord God shall give unto him the throne of his father David:

And he shall reign over the house of Jacob for ever; and over his kingdom there shall be no end.

Then said Mary to the angel, How shall this be, seeing I know not a man?

And the angel answered and said unto her, the Holy Ghost shall come upon thee, and the power of the Highest shall overshadow thee: therefore also that holy thing which shall be born of thee shall be called the Son of God.

From the bible: Luke 1, 26 - 38

And, behold, thy cousin Elisabeth, she has also conceived a son in her old age: and this is the sixth month with her, who was called barren.

For with God nothing shall be impossible.

And Mary said, Behold the handmaid of the Lord; be it unto me according to thy word. And the angel departed from her.

Master of St. Gereon, 1000

Hitda Codex 1020 (Darmstadt)

Hitda Codex 1020 (Darmstadt)

Pietro Cavallini 1291

Duccio di Buoninsegna 1303

Boucicaut 1410

Fra Filippo Lippi, after 1443

Piero della Francesca   1455

Piero della Francesca 1470

Carlo Crivelli 1486

An explanation

In Christianism God is ONE in three Persons:

the Father

the Son (Jesus, the incarnation of God)

the Holy Spirit

The holy Trinity

The Discovery of Perspective

How to represent SPACE in a plane picture?

In the 14th century it were painters that discovered perspective. Piero della Francesca wrote the first book on it. It contains detailed exact descriptions of geometric constructions of perspective pictures, beginning with pictures of simple figures like squares and ending with, for example, the geometric construction of the perspective image of a head.

One may consider as a point of culmination of this art the fresco by Raphael

School of Athens 1509/10

Principle of Perspective
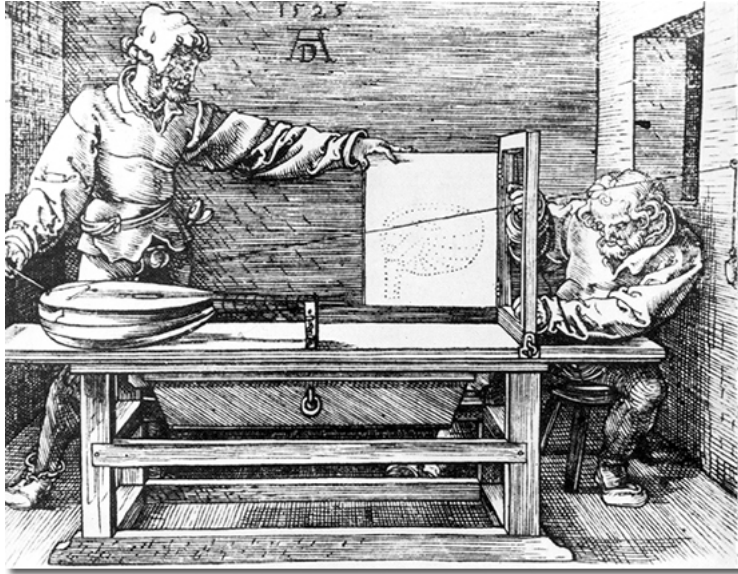
One-Point Perspective
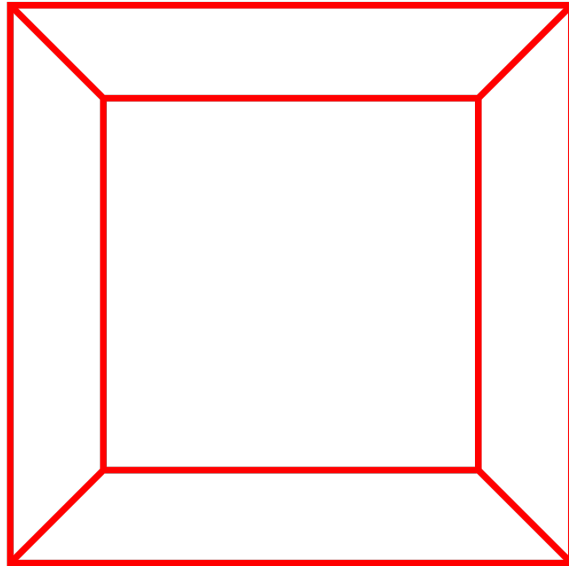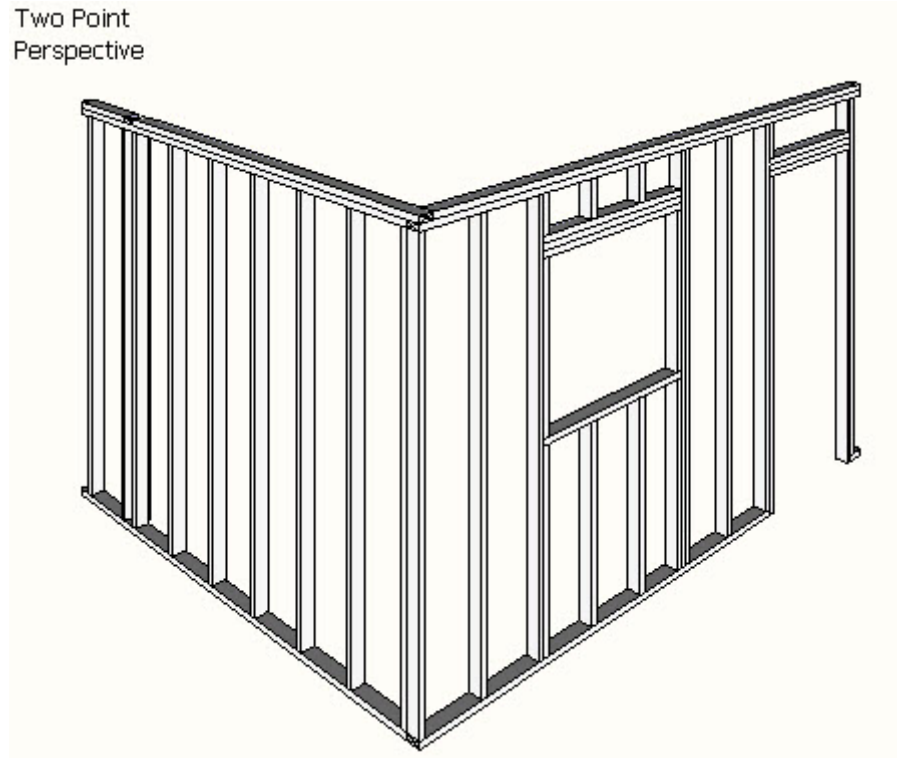
One-Point Perspective

One-Point Perspective

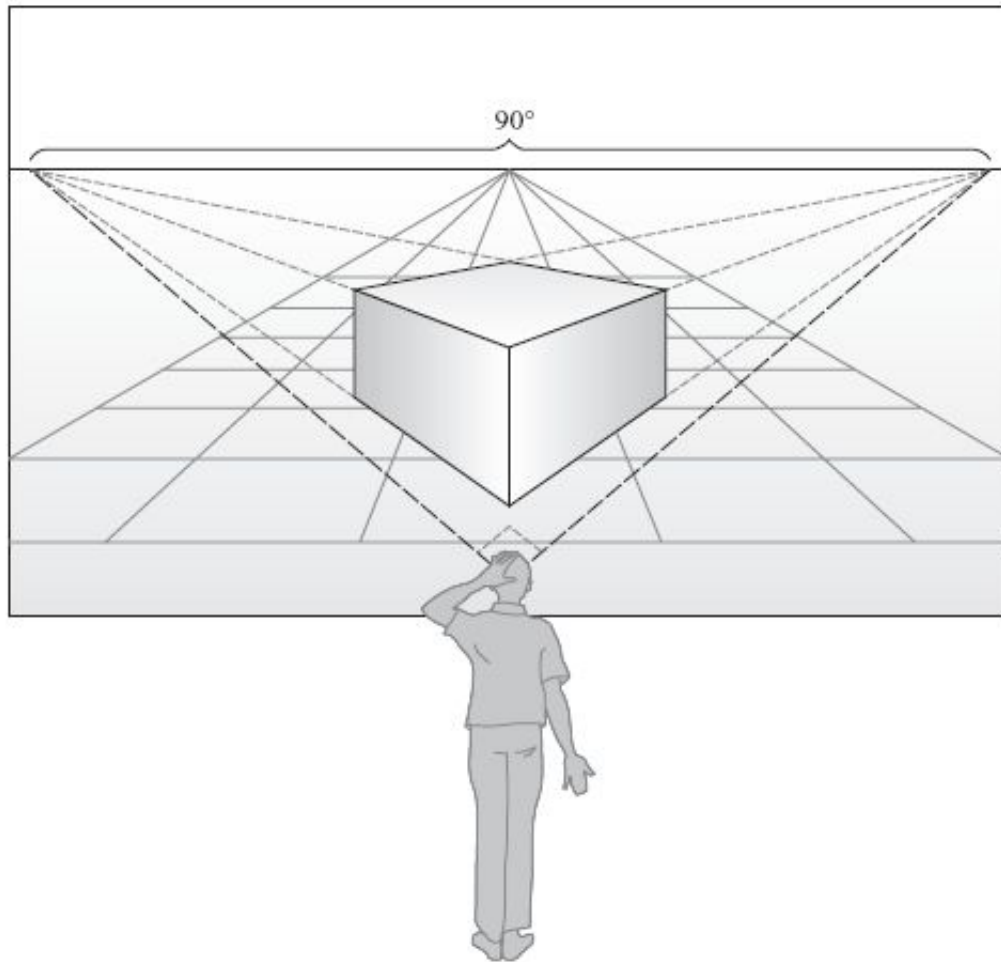# Two-Point Perspective

Two-Point Perspective
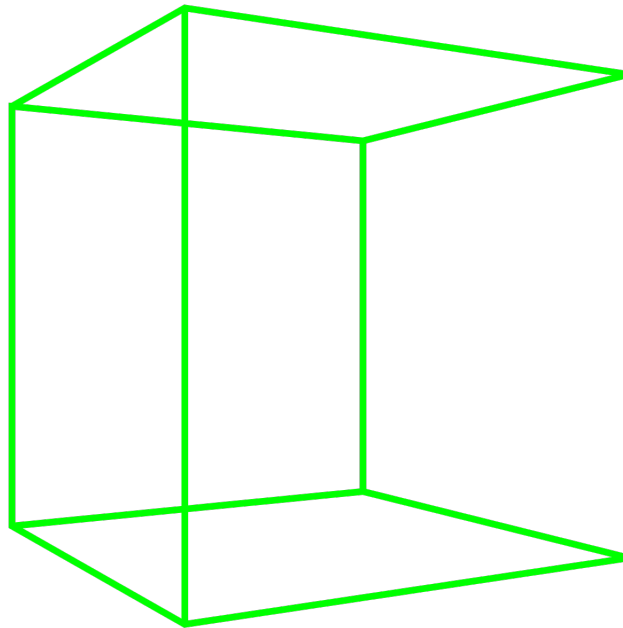
Two-Point Perspective
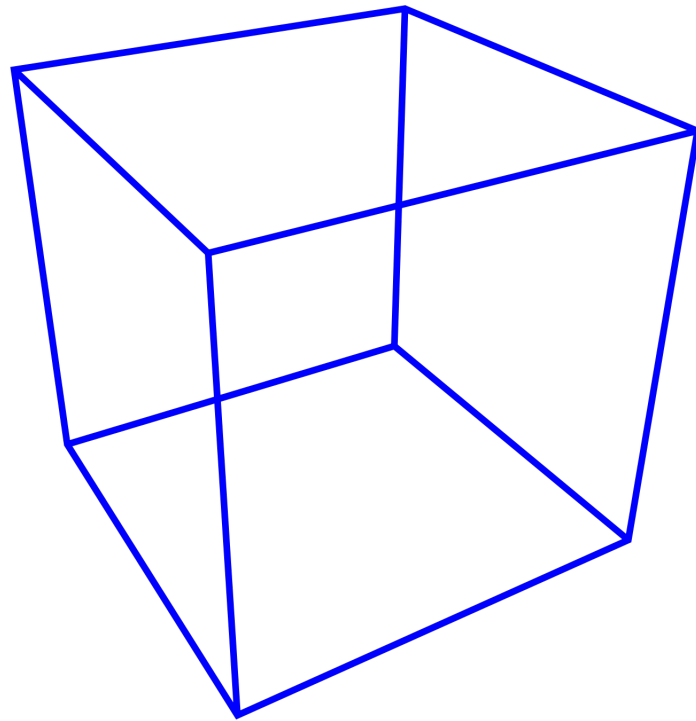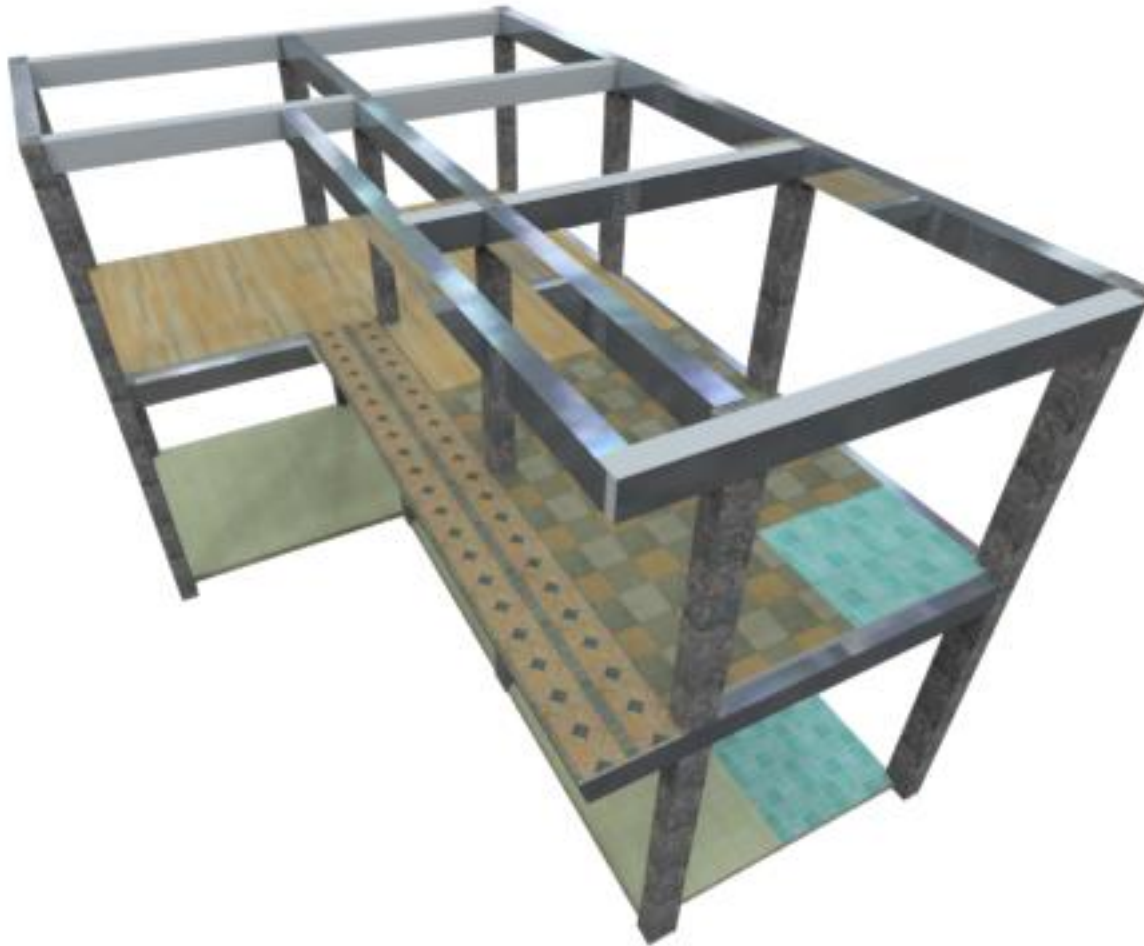
Two Point
Perspective

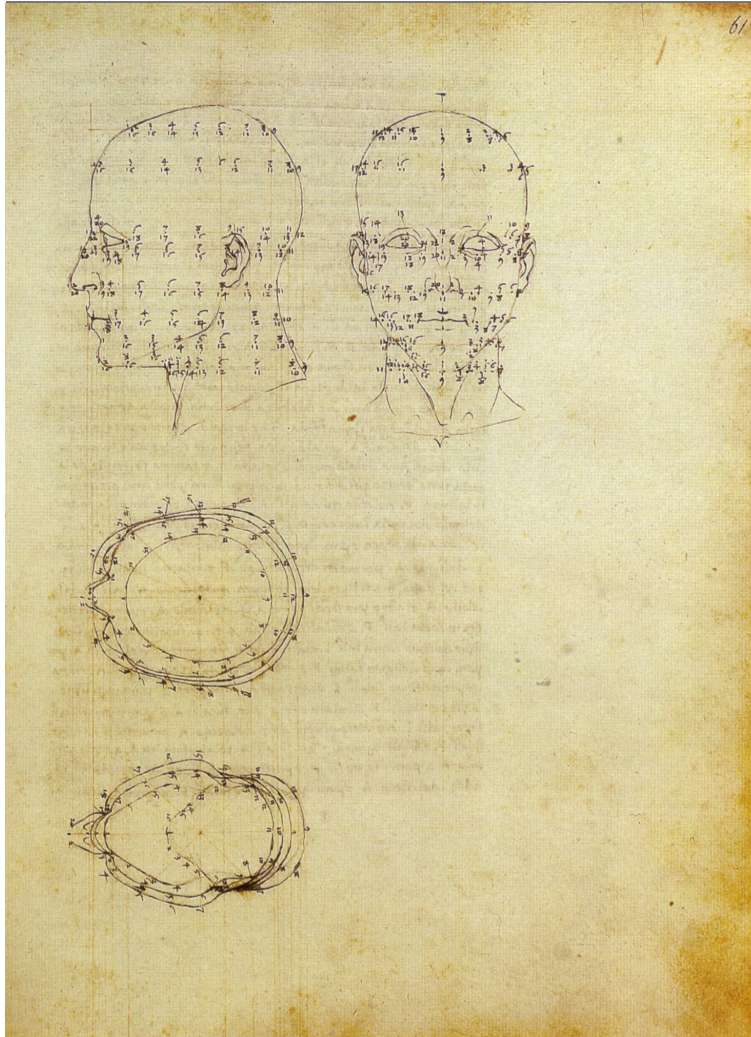# Two-Point Perspective

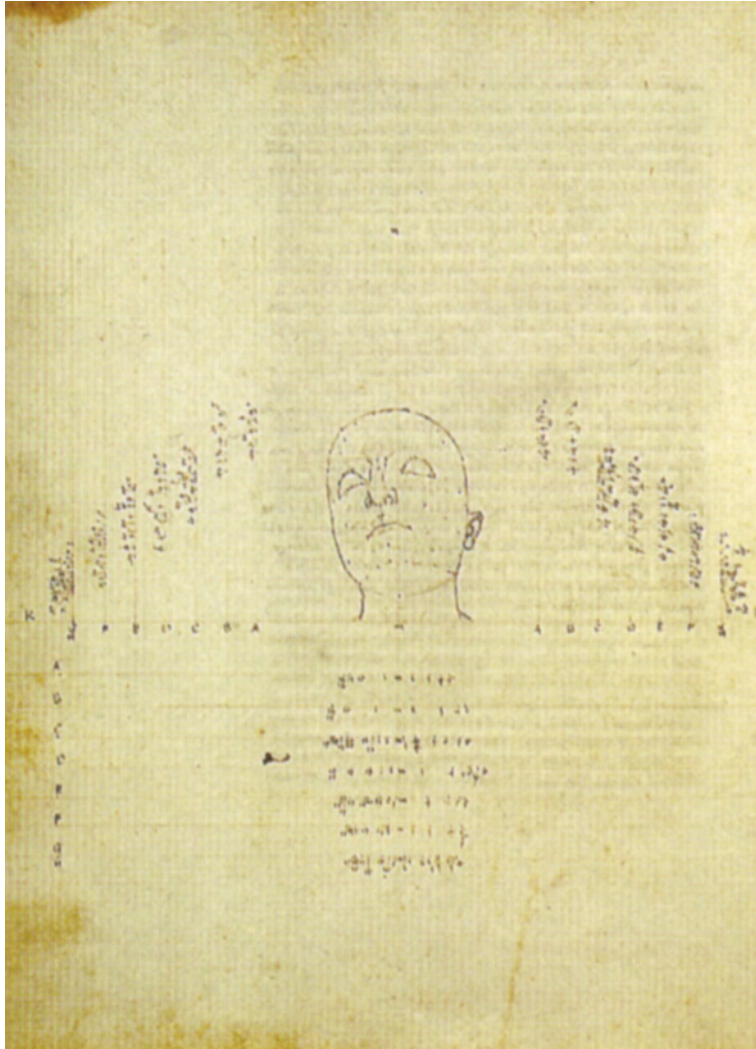# Three-Point Perspective

Three-Point Perspective

Three-Point Perspective

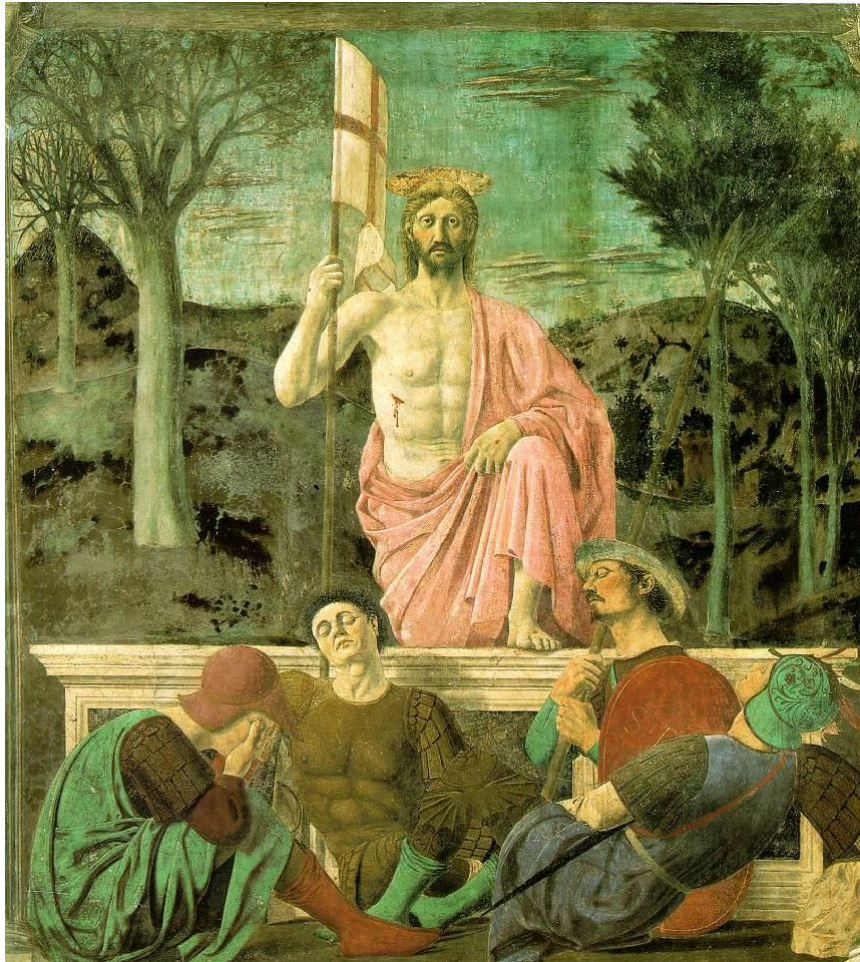# Piero della Francesca

Piero della Francesca

Piero della Francesca

Piero della Francesca

Principles of Perspective

Suppose that the painter looks straight ahead in a fixed direction d indicated by the point I at the horizon.

The lines parallel to the direction d are represented by those lines meeting in the point I.

Vertical lines are represented by vertical lines.

The vertical planes containing a line parallel to direction d are those represented by planes meeting in the vertical line i through the point I.

Top and Side View
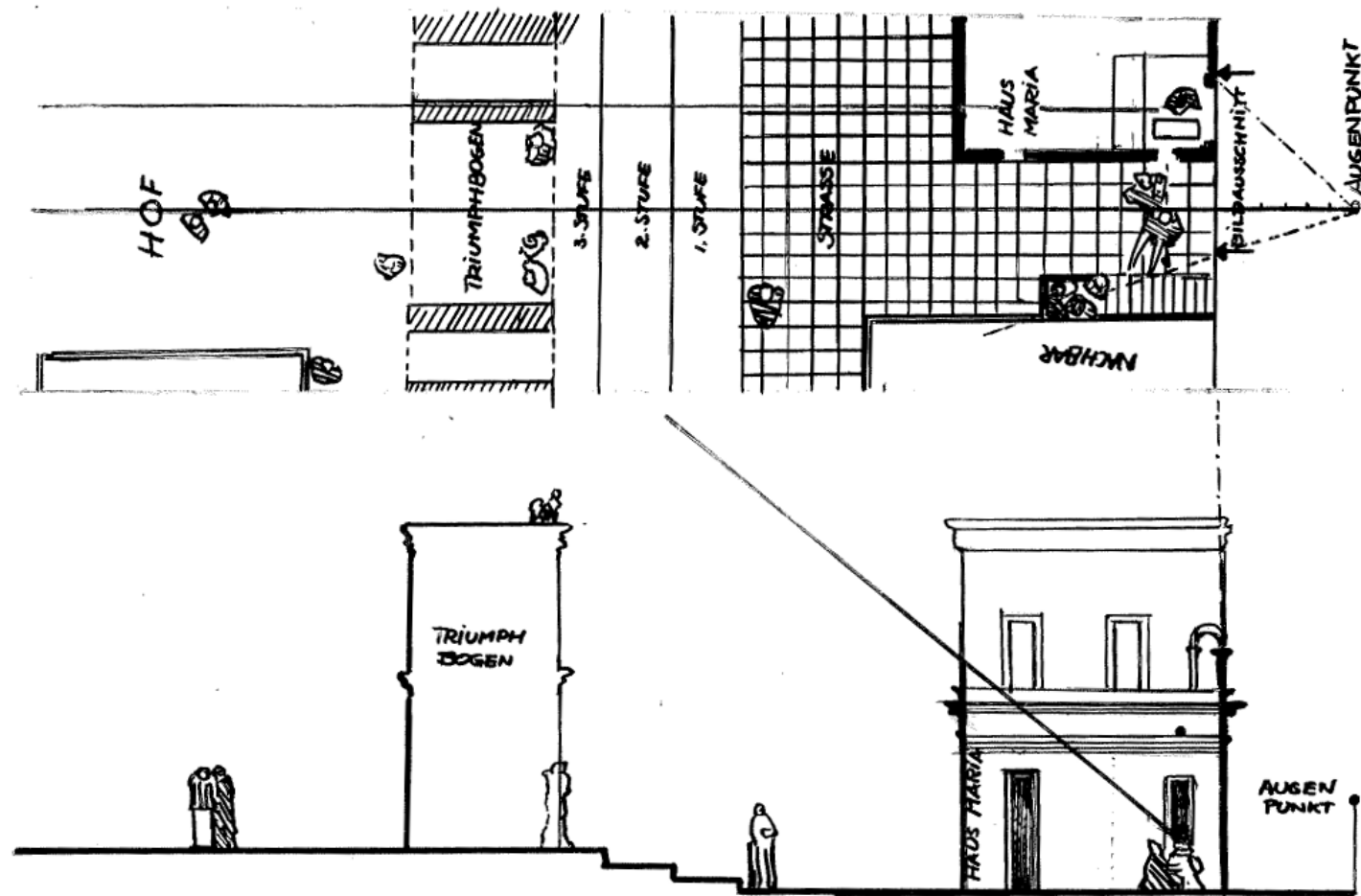
Summary of Observations

1. The vertical plane P_1 through the observer's eye, which is parallel to the third main pencil of parallel lines, projects onto the plane of projection as the one vertical crack in the tiling of the ground of the street.

2. The singular ray is contained in a vertical plane P_2 which is parallel to P_1.

3. The singular ray cannot have points in common with the plane P_3 determined by the wall (the south wall) bounding the house to the street which is in fact parallel to P_1 and P_2.

4. It is mathematically correct that the singular ray enters into the house through the wall in the back of the house, and in exactly the same point marked by the golden opening in south wall.

Interpretation

Alternative 1. The painter made this mistake deliberately: it is not conceivable that the Holy Spirit enters the house though the back door like a thief.

Alternative 2. God does not have to obey to the laws of geometry, although he has created these laws.

Remember from the bible:
For with God nothing is impossible.

But there was s silent hypothesis, under which our conlusion was derived. Namely???

3D Reconstruction

Renaissance Books on Perspective

Leon Batista Alberti:

Della Pittura (1435)

Piero della Francesca

De prospectiva pingendi (between 1474 and 1482), and

De quinque corporibus regularibus (after 1482)

Albrecht Dürer: Unterweisung der Messung (1525)

For more references, see J. V. Field:

The Invention of Infinity.

Mathematics and Art in the Renaissance

Oxford University Press (1997)

A Personal Perspective

darstellende geometrie
blatt 4
klaus keimel ss 1960